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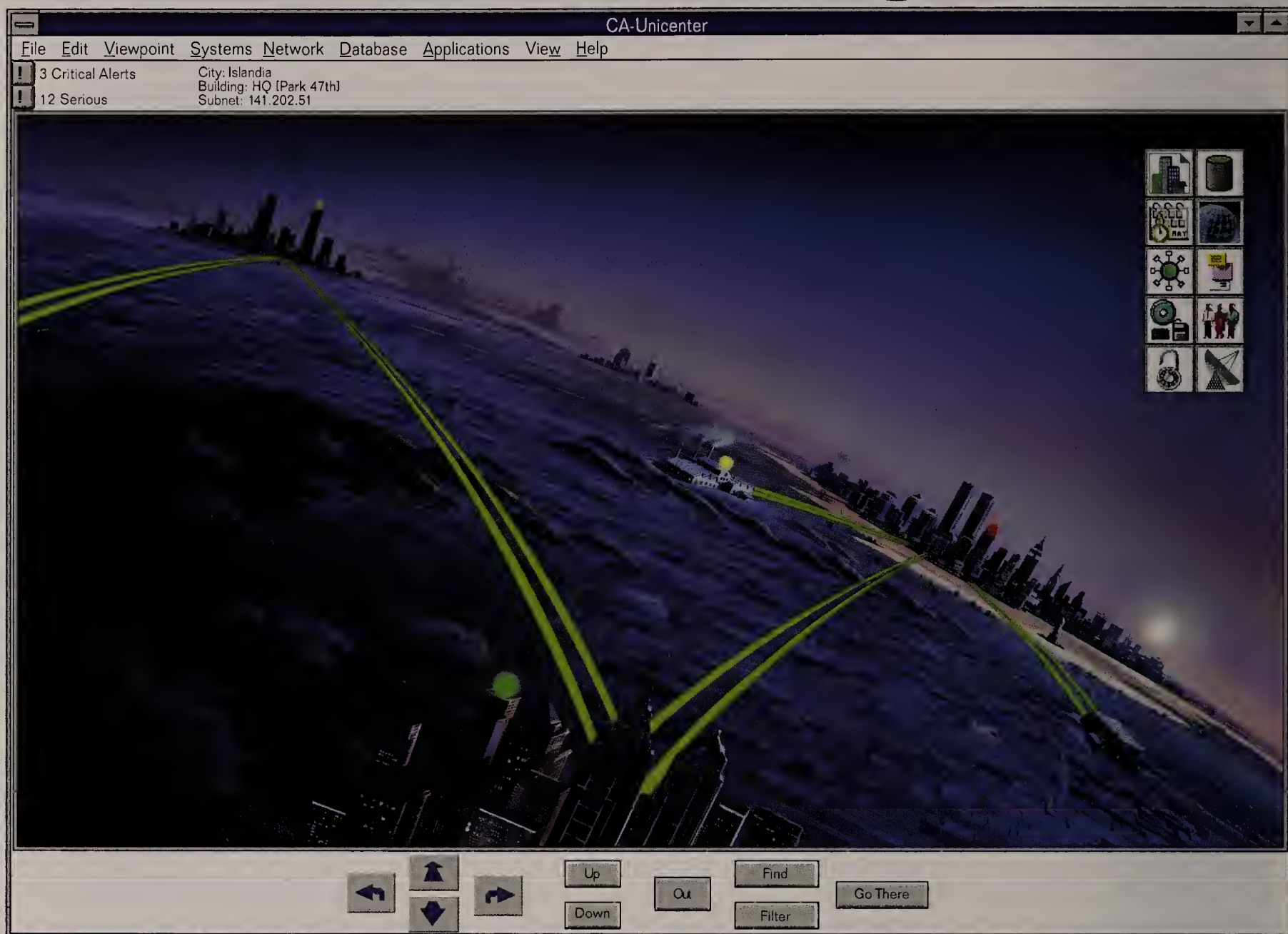
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CIO

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SPECIAL SECTION

I.T. RISK MANAGEMENT

Taking Your Chances

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New pressures and higher stakes are forcing companies to rethink how they justify and oversee IT risks.

By Lynda Radosevich and Cheryl Dahle

A Road Map for Risk

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Methodologies point out paths to success and paths fraught with peril. By Carol Hildebrand

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According to management expert Erwin Martinez, the greatest threat to the success of any IS project is a failure to communicate.

By Carol Hildebrand

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The Science of Software Development

Faced with shrinking cycle times and the threat of outsourcing, more companies are turning the dark art of software development into a science. This transformation includes instituting formal methodologies, seeking out the best of best practices and benchmarking progress against established models of excellence.

By Mickey Williamson

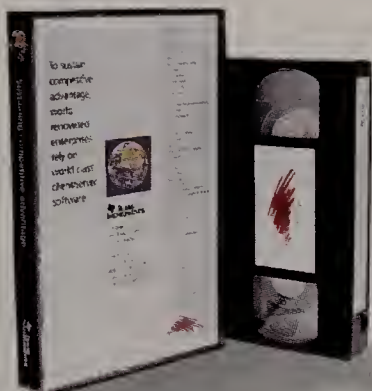
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demystified 62

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Building a knowledge-sharing database taught Arthur Andersen a thing or two about implementing changes that fundamentally shift the way a company does business.

By Wendi Bukowitz

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The benefits of client/server projects are many, but they're not always obvious. *By Ken Dec*

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STATE OF THE ART: WHO'S MINDING THE STORAGE?

One of the byproducts of the information age is the spectacular growth in a company's need to stow crucial data. Luckily, it's getting easier and cheaper to do. *By Daniel Gross*

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Faced with mandatory restrictions and demanding customers, a water utility turned to client/server technology and in the process realized significant financial benefits.

By Jennifer Bresnahan

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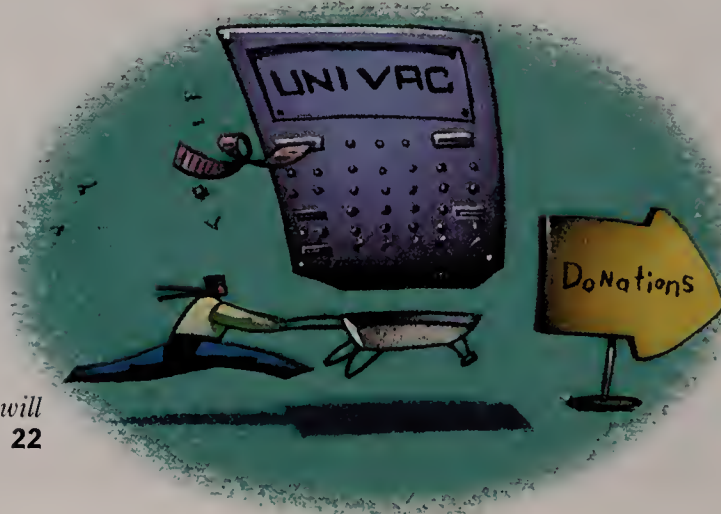
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Managing risk within the IS function is a tough one. Risk is everywhere. What technologies will be critical to your company's immediate and future success? What vendors will make sound and stable business partners? What capabilities should you keep in-house and what should you outsource? How can you keep massive development projects on target (regarding systems capabilities) and on track (managing the time/budget equation)? And how about that year 2000 problem?

Those are the risks you're helping your companies face. There are personal risks as well: It's not easy to tell the boss that many of your legacy systems are set to blow up when the clocks trip over at midnight on Dec. 31, 1999, that it's going to cost millions to fix the problem, and that the problem exists in the first place due to a lack of foresight on the part of IS.

If the risks are hard to pin down, techniques for managing them are even harder. A lot of intellectual capital has been spent on developing complex methodologies for managing risk. On the other hand, when it comes to justifying a system based on potential strategic advantage, a CIO often has to go on an inherent understanding of the marketplace and a lot of gut feeling. As Boston University's John C. Henderson says, "We are not going to discover a formula that deals with the uncertainty of the world. What we can do is put in place a systematic framework for thinking about the uncertainty of the world." (Our coverage of risk management begins on Page 36.)

This is not a sporadically occurring problem, and there is no simple solution. There is an element of risk in every decision a CIO makes. Learning to manage risk is something all IS executives must assimilate into their jobs.

What are your greatest risk issues, and how are you dealing with them? Have we covered the critical points in our articles on this topic? Please send us your feedback; we'll publish letters of interest to readers in a future issue of *CIO*. You can send your comments to me by e-mail (lundberg@cio.com) or post (Abbie Lundberg, *CIO Magazine*, 492 Old Connecticut Path, P.O. Box 9208, Framingham, MA 01701).

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Risk. What does it mean for CIOs? Some of the most significant risks in these times of intensely competitive technology markets involve the IT purchase decision. With so many types of products becoming critical to business success and with so many new and established vendors vying for every CIO's attention, how can these risks be successfully managed?

Increasingly, they are being negotiated face to face, vendor to client. Successful technology companies are spending more time not only marketing to potential customers but, more important, educating and building relationships with them. CIOs are

extremely receptive to vendors that offer council and context, not just impressive technology.

But CIOs are also wary. With so many technology companies knocking at their doors, it's not easy to know which ones to trust. At CIO Communications Inc., we provide a variety of forums for information exchange between our two key constituents: IT decision makers and the solutions providers that serve them. Because of our unique position in the marketplace, we know which issues are of critical concern to information executives. Because of our rich offering of quality print and online publications and executive programs, we offer an environment conducive to the delivery of information to help minimize risk in the IT purchase process.

Inherent in today's environment of risk is opportunity. Many vendors are operating quite comfortably in this new climate, building strong relationships with IT executives and supporting every sale with service and information. Others have yet to make the transition. We hope that readers and technology providers alike will look to us as both a source of information and insight to understand this new model and as a forum for participating in it.

Wayne L. Woz

P.S. The first WebMaster Perspectives conference will take place Aug. 11-14 at the Westin St. Francis Hotel in San Francisco. Meet and network with executives facing similar business challenges and opportunities, and learn how to effectively conduct business for profit on the World Wide Web. For more information, please call 800 355-0246, or visit our Executive Programs pages on the Web at <http://www.cio.com/conferences/proghome.html>.

Coming In CIO

New Kid On The Block

The advertising game isn't what it used to be—ad agencies are beset by stagnant sales and the fragmentation of traditional media. To help target buyers in myriad market segments, agencies have turned to technology solutions: cable TV, videocassettes, CD-ROM and the Web. As a result, the title of CIO, previously foreign to Madison Avenue, has begun to appear on organizational charts.

Who's The Boss?

In a widening variety of industries and under a number of different rubrics, vendor-managed inventory is transforming supply chain management. The technology-heavy practice of giving suppliers access to sales data can help ensure just-in-time deliveries. But putting inventory management in the hands of vendors depends heavily on accurate data and reliable communications and requires IS executives to walk some fine lines.

After the Deal

Outsourcing relationships can begin with boundless promise, but even the best-planned contract is no guarantee of success. Strife lurks at every turn in the form of governance issues, personnel changes, evolving needs, oversight, penalty provisions, lack of enforcement and the sticky issue of conflict avoidance, among other things. Outsourcing veterans say success depends every bit as much on relationship management as on the wording of the contract.



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Protects valuable data with Internet firewall support for your PC (SSL, SOCKS, ANS, others)	YES	NO	NO
Increases desktop flexibility by allowing you to run Network applications over IP	YES	NO	YES
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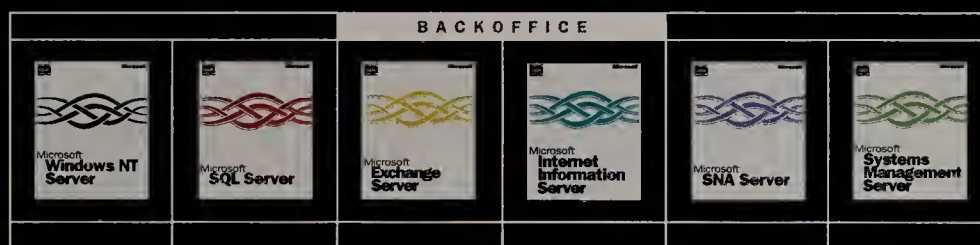
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TRENDLINES

DOWNSIDIZED & OUT

SURVIVING THE (BIG) BLUES

When you see the tissue box on the otherwise empty desk, you know that downsizing is not just a word anymore. Some exec with a golden parachute and a cracked Ouija Board made a call so lousy the red ink threatens to capsize the company unless it discards a little ballast. A dozen years of service—now suddenly you're ballast?

Is there life after Digital? Or AT&T? Or IBM?

Actually, yes there is. According to downsizing survivors, the trick to staying afloat is to hang together, stay in touch, rely on other veterans and drop a dime when it can do a former colleague some good.

Linda Anderson, a co-founder of Big Blue Alumni International (BBAI), had two decades of service with IBM software development when, in 1993, she voluntarily departed because weathering another "five years of turmoil made no sense." Since then, she has made it her mission to work with former "IBMers." "When an employee is downsized, the family is downsized," she says.

More than 2,000 former IBM employees have anted up the \$24 per year for membership in BBAI. The nonprofit organization is



"open to all IBMers—past and present" and has no official ties to that international computer company headquartered in Armonk, N.Y. Via a newsletter and an extensive Web site (<http://www.bbai.onramp.net/bbai/index.htm>), members are not only updated about changing benefit packages and the action in their ESOP accounts but also informed of employment and entrepreneurial opportunities. The BBAI Web site links to members' e-mail addresses and an HR directory with listings that span from New York to Hong Kong.

Veterans of Ma Bell, all of her children and their spinoffs will find solace and opportunity at the AT&T Employees Resume Web Site (<http://www2.best.com/~attres>). Past employees can post a resume in electronic form for \$10 or mail or fax a resume for posting for \$20, and the site features press releases and links to other sites relevant to telecommunications workers.

One-time employees of

Digital Equipment Corp. haven't gone online, but Jan Bunker, founder of *The Digital Alumni Newsletter*, expects that to happen soon. The venture she began in 1993 "has rounded the corner to where we have started to make some money." About

2,000 subscribers pay \$20 per year for the approximately 10-page quarterly edited by Bunker and Marcia Donaldson. Donaldson says the Amherst, N.H.-based newsletter is a viable business because former employees of Digital "care about one another" and "camaraderie still exists, coupled with that entrepreneurial spirit."

They are especially proud of an interview with Digital's

former CEO, Ken Olsen, his first interview since he resigned from the company in 1994, and both editors relate with relish how a hospitalized former colleague recognized the resident tending his bedside as another former Digital employee, one who had enrolled in medical school despite being in his 50s.

Being downsized is not the end of the world; in fact for displaced workers who discover each other as a community, it marks a new beginning. As Anderson points out, for most people, leaving a company "is a little like graduating from college. They enjoyed it, but they don't want to go back again."

—Perry Glasser

STORAGE: THE COST OF BEING A DATA PACK RAT

- For every dollar spent on storage, a company will spend nearly \$7 per year managing that storage.
- Storage requirements are growing at rates exceeding 60 percent per year.
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TRENDLINES

MARATHON TECHNOLOGY

RUNNING LIKE CLOCKWORK

Running a marathon can be a daunting task in more ways than one. Sure, there's the physical challenge of pounding 26.2 miles of pavement,

was used to check in runners at the starting line. "It was really a way to double check for cheaters who don't complete the entire course," explains Alice Schneider, director of computer services for the New York

runners. At the finish line, race workers punched the bib numbers of randomly selected runners into handheld keypads linked to timing machines. As runners crossed the line and headed into chutes, volunteers collected the bar-code tags, which were then scanned and put on a spindle in order of finishing. A computer matched the actual times of the se-

lected runners with the relative order of all finishers to produce the official race results.

Information technology also plays a role in the April 15 centennial running of the Boston Marathon, organized by the Boston Athletic Asso-

ciation, where a relatively novel timing approach is being used. Runners are wearing computer chips tied to their shoelaces that function as tracking devices with personal serial numbers. As runners pass over antennas located under

CAREER MOVES

CHARLENE T. BARNES

has been appointed senior vice president and CIO of Mesirow Financial. She was previously president and founder of Small Business Systems Software.

RICHARD W. BRIGHTMAN

has been named vice president of information services at LIB/GO Inc. He was formerly director of IS at RJR Nabisco Inc.

mats at the starting and finish lines, a radio signal automatically records and transmits the times to laptop computers. The idea behind the chip is to accurately record the length of time runners actually spend on the course. With an official field of more than 35,000, the unfortunate runners at the back of the pack will likely need a half-hour to inch their way across the starting line.

—Megan Santosus

running so hard for so long that the thought of being numb from the waist down is actually appealing. But have you ever thought of the logistical challenges posed by the need to track tens of thousands of runners and accurately record their times as they cross the finish line?

It turns out that information technology can help. At the 1995 New York City Marathon, the same bar-code and scanner technology that UPS uses to track packages

Road Runners Club, the organizer of the annual five-borough event. Each runner wore a bar-coded registration number on a perforated tag at the bottom of his or her race bib. In all, 48 UPS volunteers used 15 scanning systems to check in 26,288

CORRECTION

The figures in the chart appearing on Page 14 of the March 1 issue of *CIO* should be represented in millions, not thousands. We regret any confusion this may have caused.

Why Johnny Can't Compute

Major barriers to using advanced telecommunications in U.S. public schools

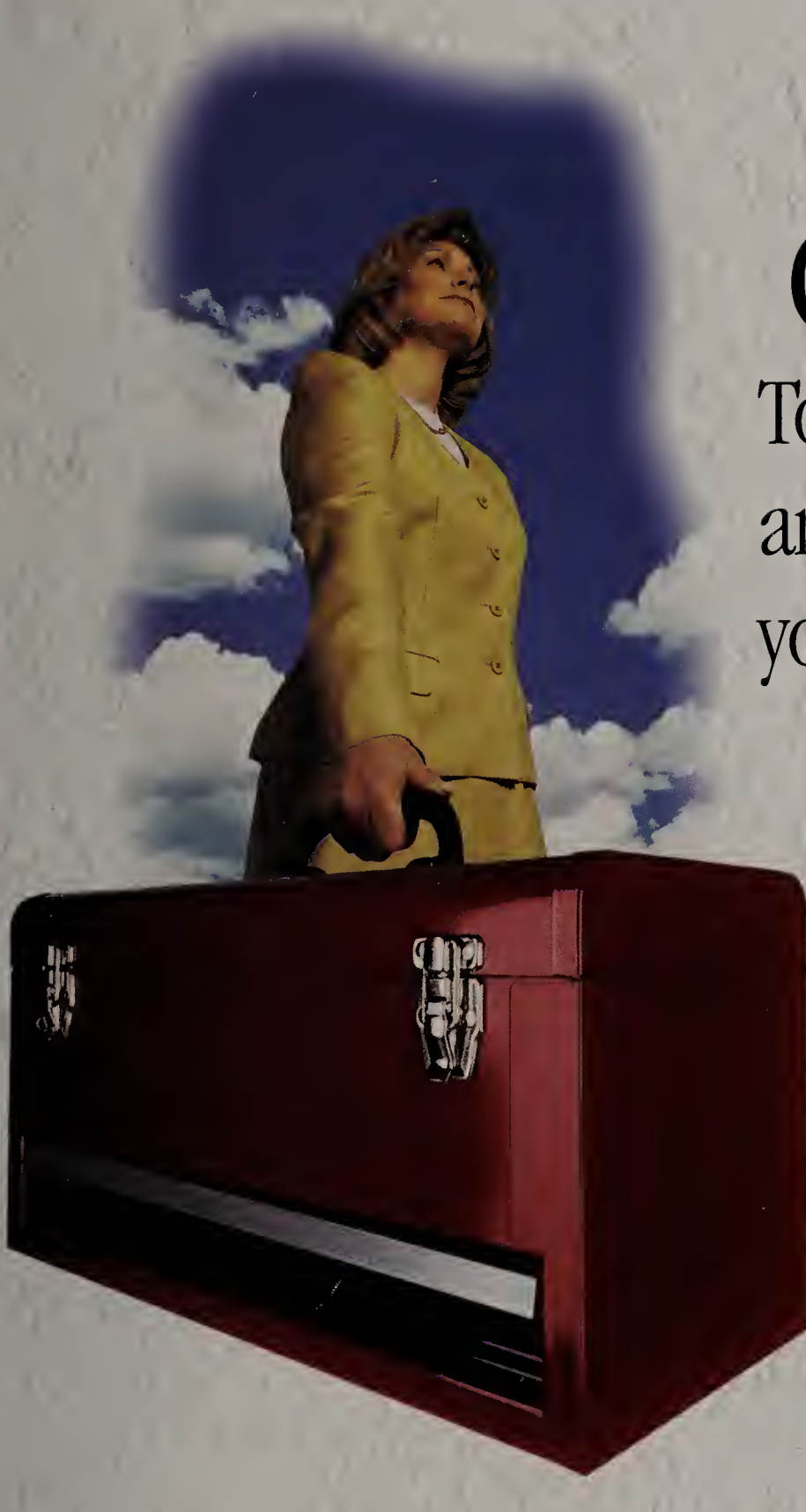
69% of schools cite a lack of funds

50% of schools say they have poor or no equipment

36% of schools say they lack trained staff

28% of schools cite a lack of adequate hardware maintenance

SOURCE: 1994 U.S. DEPARTMENT OF EDUCATION SURVEY ON ADVANCED TELECOMMUNICATIONS IN U.S. PUBLIC SCHOOLS, K-12



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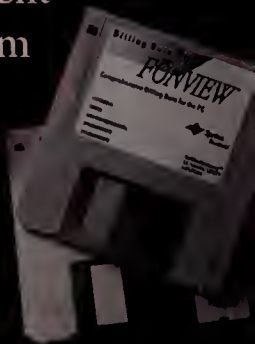
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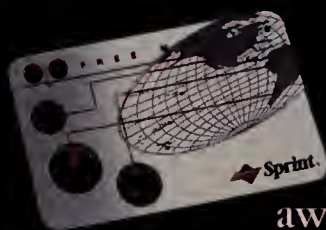
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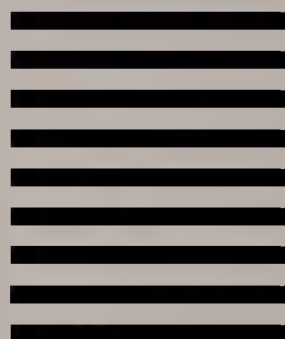
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TRENDLINES

A WORD TO THE UNWISE

From its home office in Norwell, Mass., Giga Information Group Inc. presents the top 10 ways NOT to reengineer:



Commit to whatever top management asks for—they're the boss!



Agree that certain procedures are untouchable—you can always work around them.



When vendors claim that their solutions are open, seamless and intuitive, believe them.



When vendors stress their flexibility, assume they are talking about their products. (Actually, they are talking about their use of *marketing language*.)



For your key IT person, appoint someone who is aggressively looking to leave your company for another job.



If you lose your key IT person, replace him or her with an end user who has no IT knowledge.



Break completely from the past—follow the example of the Denver Airport.



Lock in changes permanently—you've thought of everything.



Avoid overcommunication—don't spoil the surprise.



Don't worry. Be happy.

SOURCE: 1996 GIGA INFORMATION GROUP INC. BUSINESS PROCESS AND WORKFLOW CONFERENCE

USER FRIENDLY

(DE)SIGN OF THE TIMES

If you build it, they will come. Unless "it" is software and "they" are users, and you build it so that it's intimidating or inconvenient or just plain indecipherable. Then, they will flee—or jam your customer support lines with calls, smear your company's reputation on Internet newsgroups and use your product as a paperweight. (Hey, at least the *packaging* was useful.)

Companies hoping to avoid this scenario are increasingly turning to something called user-centered design to anticipate and incorporate users' needs earlier in the development process of applications, whether they are for internal or external use. The idea that fuels user-centered design—that products should be tailored to users' requirements and instincts—is nothing new. "Human factors engineering," "ergonomics" and "usability testing" have been part of the lexicon of product development for some time. What is new is the growing acceptance of this idea in traditionally staid corporate environments as well as its evolution from an after-the-fact rubber stamp to an integral, iterative part of the

design process.

"For the first 10 years of my business, I couldn't get anyone interested except the government," says Charles Mauro, a human factors engineer and president of Mauro/Mauro/Design Inc. in New York. "Five years ago, corporations started to get interested. And now, there's so much work out there, it's unbelievable."

Mauro, who has more than 20 years of experience in the field of human engineering, tells stories of poorly designed products that would leave the mouths of a company's marketing gurus with a sour New Coke-like aftertaste: the

printer driver software that was so difficult to install that more than half of the first 100,000 customers called the help line at a cost of nearly \$500,000 per month to the manufacturer; the digital watch that was so impossible to set that many customers reported regularly stashing the timepiece under couch cushions to prevent the alarm (which they could not figure out how to turn off, even with the help of a 30-page manual)

from waking them at night. Mauro's firm recently helped the New York Stock Exchange (NYSE) design a user interface for a pen-based, handheld wireless computer for its staff and brokers. The device enables staff to report trades and quotes. Compared with the paper-based system, the de-

50% of Americans can't work features of programmable equipment, including VCRs, telephones, fax machines, thermostats and coffee makers.

SOURCE: MARKETING SPECIALIST LAURENCE FELDMAN

Calls to a software support line typically cost the manufacturer between \$4 and \$10 per call.

SOURCE: MAURO/MAURO/DESIGN



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TRENDLINES

vice has reduced data entry errors and in some cases speeded up trade executions by as much as 50 percent, Mauro says. While the NYSE declined to release figures on its return on investment, the increased efficiency does translate into profits for the exchange, says Anne Allen, vice president of floor operations. "If we build something that makes the staff more effective, and we increase our volume, the stock exchange will prosper, and it'll be great

for business," Allen says. "That's what it's all about."

In the '80s, companies typically completed a product and then addressed usability issues, says John F. "Jeff" Kelley, chairman of the computer systems technical group for the Human Factors and Ergonomics Society and a research staff member for IBM's Interactive Transaction Systems (ITS) team, based in Yorktown Heights, N.Y.

"We played the traffic cop

role," Kelley says. "I think that human factors might have gotten a bad name among some developers because of it."

Since then, the discipline's focus has shifted to encompass detailed analyses of the complexity of user tasks and a more iterative process that allows user-centered design to drive the functions of an interface as well as its usability, Kelley says. Today, instead of delivering three-inch-thick binders with

specs, human factors engineers produce programmed prototypes that show how an interface will work and look. In some cases, using object-oriented programming, they deliver a working application in rough form.

IBM's ITS team used that approach to design multimedia workstations used in the 1992 World Exposition (Expo '92) in Seville, Spain. The 231 networked workstations, grouped in kiosks, enabled users to learn about exhibits, place reservations at local restaurants, leave video and text messages for other attendees and read news-service feeds. More than 15 million people logged onto the workstations, Kelley says.

"We're not just a bunch of weirdos putting people on couches asking them how they do their jobs. We're serious about how [user-centered design] can affect the bottom line," Kelley says.

"We can make an application useable, useful and fun."

—Cheryl Dahle

PITCHING IN INSTEAD OF PITCHING IT OUT

Those loyal 286s you bought in the '80s were once the best binary brains the industry had to offer. Now that they've been out-

RAMed and out-megahertzied by their flashier, faster progeny, is that any reason to banish them to the storeroom with the mops and Lysol? Wouldn't you rather give your little friends happy new homes where they'll be loved, cared for and used?

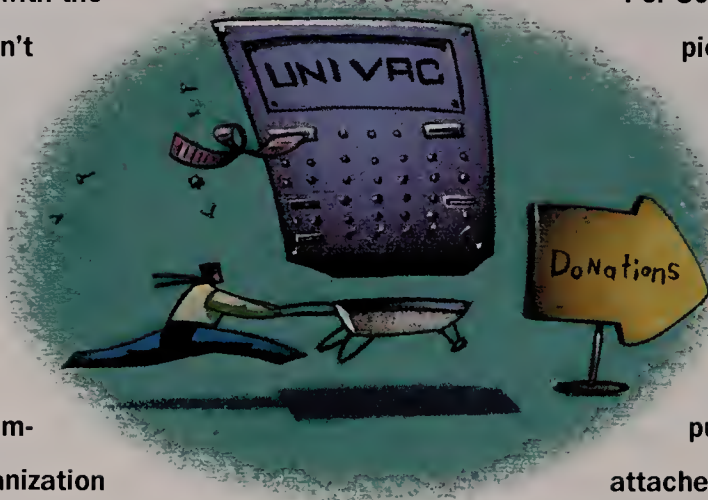
Then give them to Per Scholas Inc. The company is a nonprofit organization tucked away in the South Bronx that buys and accepts donations of old computer equipment from companies and resells it cheaply to U.S. schools.

"Per Scholas represents a fabulous opportunity for organizations as a philanthropic outlet for their idle assets," says Christopher Goodhue, a research director with Gartner Group Inc. "Computer education is critical to our children's future, and Per Scholas is dedicated to providing high-quality, warranted equipment to

our schools." Goodhue says that 60 percent of old equipment is left to collect dust in closets or storerooms because environmental and liability considerations prevent companies from simply throwing it away.

Per Scholas arranges to pick up equipment and then test, clean and load it with basic software programs. For large quantities of donated computers, Per Scholas attaches decals to the

equipment identifying the donor corporation. Schools can purchase a variety of personal computers for an average price of \$250; all computers come with a one-year replacement guarantee. As a corollary activity, Per Scholas also provides training to students. A weekly list of refurbished computers looking for new homes is distributed to schools via fax and the Internet. For more information, call Per Scholas at 718 292-2300 or visit its Web site at <http://www.perscholas.org>.



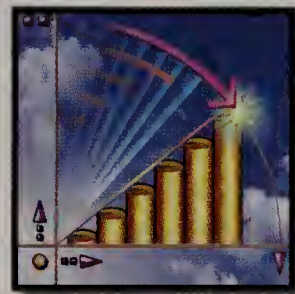
WE'RE NOT ALL CONNECTED

- Only half of the nation's public schools have one or more computers with Internet access.
- More than 90 percent of instructional classrooms are not yet connected to the Internet.
- Only 31 percent of schools with high levels of students from poor families have access to the Internet, compared with 62 percent of schools with relatively few students from low-income families.

SOURCE: U.S. DEPARTMENT OF EDUCATION

Keeping Promises.

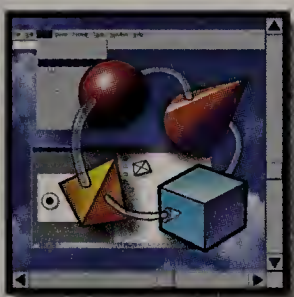
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In the Know

Building a knowledge-sharing database taught Arthur Andersen a thing or two about implementing changes that fundamentally shift the way a company does business

BY WENDI BUKOWITZ

Many companies are keenly interested in how to build effective knowledge sharing systems, given the potential payoff in improved customer service, shortened delivery cycle times and increased collaboration within the company. For a professional services company like Arthur Andersen, whose very product is knowledge, the motivation to construct a system to share that information is even greater.

In the early 1990s, Arthur Andersen began creating the Global Best Practices (GBP) knowledge base, a central repository of knowledge about world-class business practices. The goal was to capture qualitative and quantitative information about how companies achieve best-in-the-world standards of performance in activities that are common to most companies regardless of their industry. This information would then be used by more than 40,000 Arthur Andersen professionals to provide clients with an ever-growing body of knowledge that could serve as a reference point for performance improvement.

The impetus for building GBP came from the outside. Arthur Andersen needed to leapfrog competitors in the then-emerging area of best practices, so it set a three-month timetable to start advertising a resource tool to give clients access to best-practice insights. The kicker: The tool did not exist. Under the leadership of Bob Hiebeler, partner-in-charge, more than 25 industry and practice heads began a scramble to create, develop and release the GBP knowledge base. The four-year initiative has taught the project's development team some unexpected lessons about implementing changes that fundamentally shift a company's culture and the way it does business. Many of these lessons contradict generally accepted ideas about what constitutes good planning and execution.

LESSON 1: Begin before you're ready. Many managers would argue that an organization should prepare for change before it launches an innovative, large-scale initiative: The right staff should be recruited and in place, the fundamental workflows affected by the shift should be mapped out, and the technology plans should be finalized. But the surprising lesson learned from building the GBP knowledge base is that while that kind of preparation would have been ideal, it hasn't proved necessary. In the initial development process, there was not much time to discuss infrastructure building. A team of 10 people completed the beta version of the tool and two updated releases all in the same year.

Coming up for air after the second release, Arthur Andersen's development team began to wonder how to preserve the timeliness and relevance of the knowledge base. The plan called for the front line—the professionals who directly serve



ILLUSTRATION BY STEVE DINNINO

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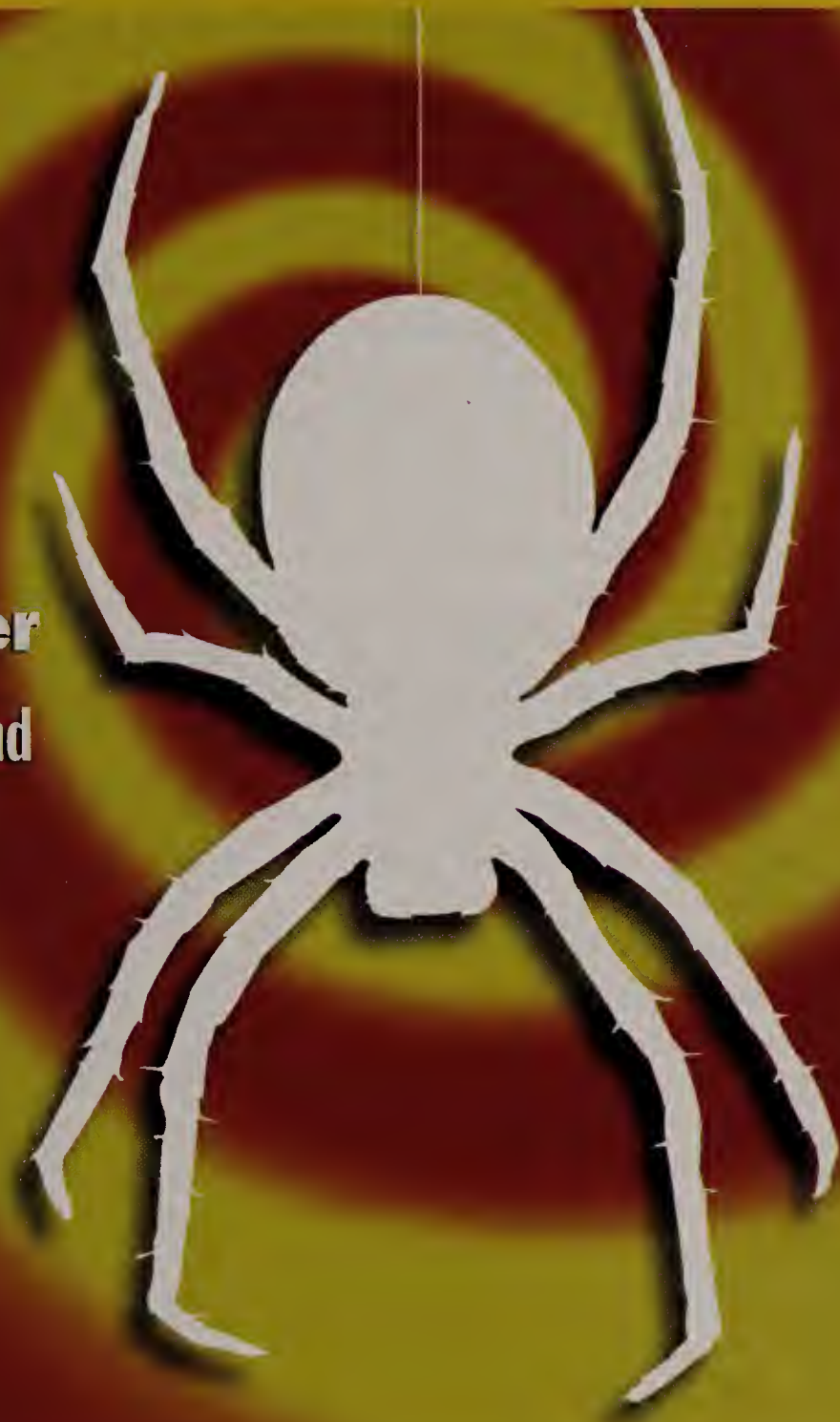
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Senior Fellow
The Discovery Institute

TIM HORGAN
Webmaster
CIO Communications, Inc.

LEW McCREARY
Publisher & Editor-in-Chief
WebMaster Magazine

LES OTTOLENGHI
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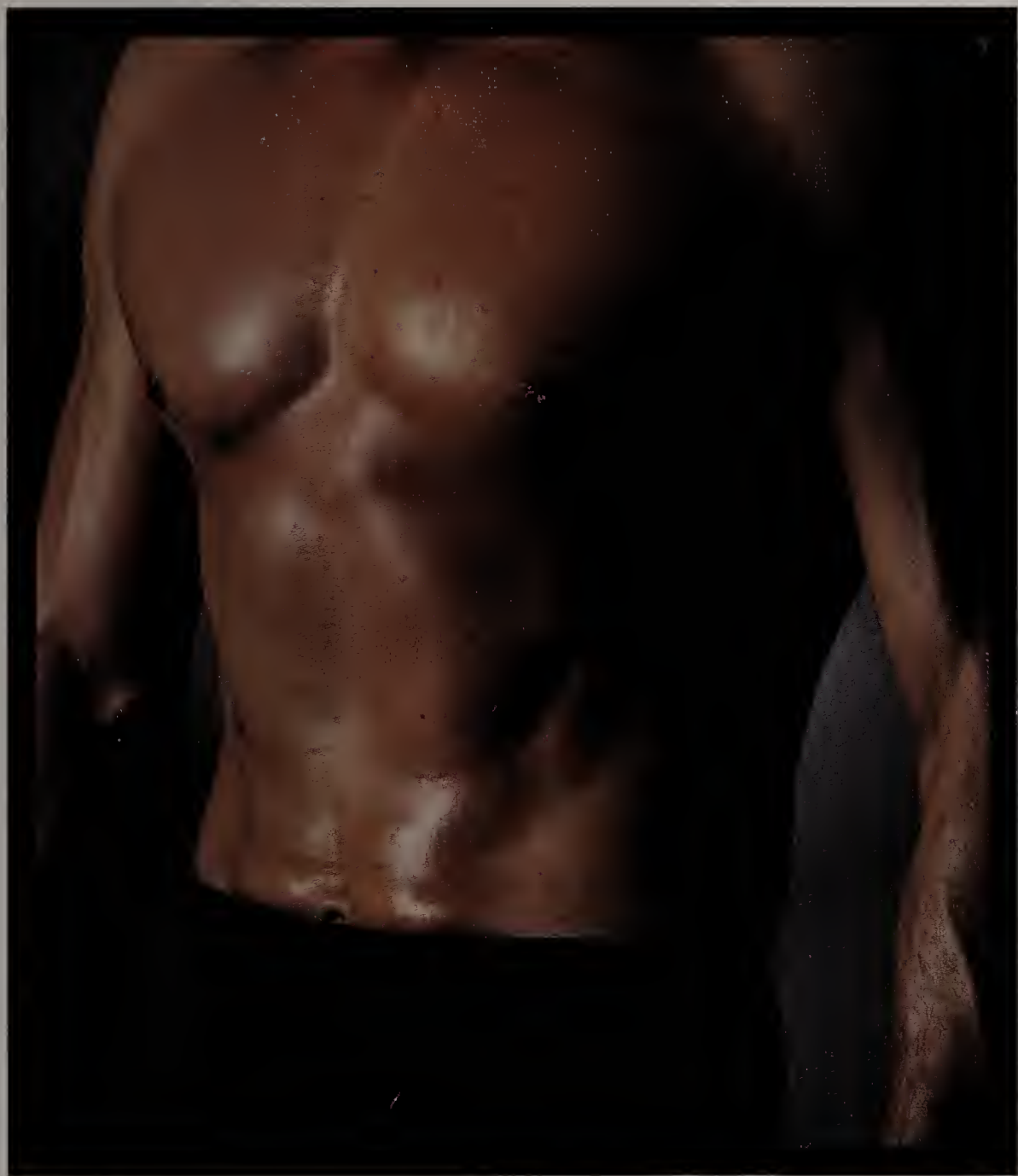
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How Arthur Andersen Gathers Knowledge

■ The Global Best Practices hot line receives more than 250 calls each month, which are tracked on a Lotus Notes database and sorted into business process categories.

■ This data, combined with ongoing research into emerging areas, is used to determine which process areas will be developed or enhanced for an upcoming release.

■ Research analysts team with content experts who serve clients to develop best practices content and diagnostic tools, about 250 pages per process.

■ Qualitative and quantitative information and tools are released on a CD that can be accessed by all Arthur Andersen professionals worldwide.

■ Use in the field with clients generates suggestions that are received by the hot line or captured through formal and informal surveys.

clients—to assume heavy responsibility for knowledge innovation. That approach made sense because the front line could identify emerging best practices in the consulting work they performed with clients. But involving them that way meant dramatically rethinking their role in the organization. They would be responsible not only for creatively delivering services but for reflecting on their activities to derive insights about them

and sharing those insights with the entire organization.

In the meantime, the development team had to design a temporary process for building and sharing knowledge while the organization began the new way of doing business. That included a transition staff of about 15 full-time people, more than half of whom were experienced contract consultants who could be reassigned when necessary. The small size and outsider status of the transition team would prevent it from becoming a bureaucratic fixture that resisted its own obsolescence.

The GBP leadership decided that the long-term structure necessary to support GBP's full potential could not be developed until this new idea of knowledge sharing had become an old one. Trying to build an integrated structure before launching the GBP knowledge base would have resulted in certain failure. Organizational resistance to change guarantees it. Transitional infrastructures that can be easily disbanded are not Band-Aid solutions—they are, in fact, the right approach to jump-starting the profound process of organizational change.

LESSON 2: Commit to a rapid release schedule. The first release of the GBP knowledge base provoked a small amount of avid interest and a much greater amount of casual dismissal; but it got people's attention, inside and outside the company. Within a year, two more releases followed, each one significantly expanding GBP's content scope and depth. Committed leaders kept the naysayers at bay by pointing to upcoming improvements that would fix known flaws, not the least of which was insufficient breadth. By the third release, the knowledge base had become a meaningful and useful tool. In an organization resigned to long development cycles, rapid releases bought the GBP development team enough benefit of the doubt for it to ultimately achieve what the organization demanded and the time to develop a broader and more useful collection of information.

The rapid release schedule also allowed Arthur Andersen to make improvements on the fly. Rather than restrict first-year activities to development, the company combined development with pilot activities. For example, the first release contained only qualitative content on 10 business processes. The second release expanded the number of processes with qualitative content and added three benchmarking tools that created a link between qualitative performance results and process improvement insights. That approach allowed the GBP team to incrementally build a dynamic tool that adapted to a user's point of view as it was developed rather than construct a completed tool that could succeed or fail only on a colossal scale.

Within the next year, an Intranet will obviate the issue of releases by providing continuous real-time access to all of Arthur Andersen's knowledge bases and to external information sources. Nonetheless, the benefit of release schedules is the discipline they impose on bringing development cycles to closure. As the knowledge bases migrate to this online environment, upgrades will feel more incremental. New information will be added on a daily basis. The challenge will be to transfer the discipline and sense of urgency acquired from rapid releases to the new environment of daily releases.

LESSON 3: Plan to dazzle your customers. If you can't commit to impressing users on a regular basis, don't even bother to launch a knowledge-building endeavor. To tempt more professionals to sample the GBP product, the team aimed to do more than merely satisfy its customers. To track its success in meeting that goal, it measured user satisfaction levels two ways: via formal surveys and records of user requests from the support hot line, and via informal assessments of satisfaction gleaned from user support interactions such as proposal preparation and presentations to clients.

The GBP hot line support service is staffed by two experienced re-



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search analysts who log all requests on a database. If they cannot help users find what they need in the GBP knowledge base or other readily accessible companywide resources, the request is passed to a team of information specialists. Two reference librarians with expertise in external sources are part of the development team and serve as on-call "custom researchers." Unless the research results are proprietary, they become part of the company's general resources. Custom research requests that fall outside the knowledge base are also tracked, and both sets of logs are reviewed as part of the process by which the team determines areas for content development and revisions for upcoming releases. The development team also uses formal surveys to obtain input from users and nonusers but conducts them judiciously. Like most companies' IS customers, Arthur Andersen employees suffer from "survey fatigue" and are increasingly disinclined to participate in even the simplest surveys. The entire company is surveyed every other year to measure improvement in overall satisfaction with the knowledge base, specific areas in which needs are not being met and the degree to which use of the knowledge base contributed to winning a client's business. The team also occasionally surveys selected groups using methods such as reader response cards attached to a bi-monthly newsletter.

Development team members frequently provide support to Arthur Andersen professionals preparing proposals and client presentations. Such interactions provide information about user and client needs, but more important, they force developers to walk a mile in their customers' shoes. This experience increases the odds that developers, consultants and clients will perceive GBP innovations as useful and timely. It also helps sensitize developers to needed improvements that could add great value but were overlooked because of lack of hands-on experience with the tools they created.

LESSON 4: Keep it in prototype longer than you think you should. The GBP knowledge base remained

in prototype for 18 months before the label was dropped. The long prototype phase permitted flaws and problems to surface and promoted a willingness to confront them head-on. Developers felt encouraged to take risks and thus released tools that might otherwise have been held back for more testing.

The prototype phase also offered developers wiggle room with users. Users expected flaws, and developers were free to innovate with impunity. In this atmosphere of continuous innovation, developers could discuss flaws rather than defend them. The prototype phase set the stage for radical additions and deletions that continue to permeate development efforts well into the fourth year. This vitality and willingness to abandon everything is the most significant legacy of the GBP's long prototype phase.

LESSON 5: If you must train, be clever about it. The most frequently mentioned reason from nonusers for not using GBP has been, "I need more training to use it." Those who actually do use the knowledge base (and who were never formally trained) have never requested training. That conflict created a debate between the GBP development team and the organization's leadership about the need for training.

The development team argued that the GBP software was friendly to the average computer-literate business user. Its contents were organized in a conceptually simple and easily accessible framework. The GBP newsletter and a virtual GBP resource center on the company's internal online discussion forum routinely reached all levels of the organization with tips and ideas about how others had used the GBP to serve clients. The team consciously took this approach to diminish the need for formal training.

Yet Arthur Andersen's leadership had a strong bias toward training. Every major change to the business had been taught to the organization through a major training program, so training for GBP was not negotiable. But the GBP team salvaged what

might have been simply an expensive exercise in awareness building. They positioned the training as the first step in a widespread pilot program to integrate use of GBP into the organization's core audit and tax

Knowledge Base Contents

- Best practices information
- Best company profiles
- Relevant Arthur Andersen engagement experience
- Top 10 studies and articles
- World class performance measures
- Diagnostic tools
- Customizable presentations
- Process definitions and directory of internal experts
- Best control practices
- Tax implications

services. Each group that participated in the training program targeted 10 to 20 clients with whom they would use GBP as an integral part of delivering service. The GBP team provided special hot line consulting support to these pilot clients. To determine the value added from using GBP, the team gathered data on key performance measures such as customer satisfaction and profitability from the pilots and compared them to organizationwide averages. That way, training was directly linked to action, and a one-time training event was transformed into an ongoing coaching process that provided support to those actively involved in implementation.

LESSON 6: Press hard on technology to deliver business value. Most of the time, GBP team members were making the process up as they went along. As users tried different elements of the tool and provided feedback about how well they worked, the team made modifica-

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tions that affected not only the content and its presentation but also the tool's functionality. For each release, the development team demanded changes in functionality that required significant rework for the software developers. The indisputable fact that the train had to leave the station on time focused the technical and strategic teams on overcoming adversity rather than on giving up with good excuses. Yet adversity abounded.

The process of creating a software application follows a generally linear path. Developers design a framework into which they slot blocks of code that execute various tasks. Creating a framework at the front end yields an elegant and simple systems design. Yet the side effect of this approach is that very early in the process, functionality and the outcomes it permits become fixed, and the only way to change it is to start over.

The software application development process collided head-on with the process the GBP team was creating to respond to user demand for a more flexible and dynamic tool. As each new GBP development cycle began, the software application group insisted on receiving a complete set of user requirements. The GBP team struggled to obtain feedback from users about new functionality as they began to use the new release. But trying to assess what needed changing so early in the process didn't allow for the requests that emerged from repeated usage in the field.

That difference between the two world views has never been fully resolved. Yet, the GBP team and its software developers have agreed to work toward a more harmonious and congruent development process.

LESSON 7: Rely on fuzzy feedback before hard measures. New approaches like the GBP knowledge base must deliver benefits to users in a very short time frame, or they will not take hold. What's interesting about those benefits is that they do not have to be measurable in the strict sense. In the case of GBP, it was sufficient to generate a handful of war stories that resulted in "wins"

for the company. As these new corporate myths made the rounds, curiosity was piqued and new users sampled GBP. Even if it was a desire to debunk the new myth that inspired the trial, they had tried it.

One war story involved an audit that Arthur Andersen hoped to win

At some point, the set of highly specific and easy-to-access information that has been built to a useful level becomes an unwieldy blob of information that threatens to overload users.

from a multibillion-dollar global manufacturing company. The audit team was able to propose a review of the company's accounts-payable process based on the best practices data contained in the GBP as part of the traditional audit. Because of the significant and compelling value added by that information, Arthur Andersen was awarded the contract for the worldwide audit.

For the GBP team, collecting war stories and sharing them was the only way to demonstrate results in the early phases of implementation. At the end of the first year, it was possible to conduct market research that quantified usage patterns among a group of field professionals who identified themselves as users. Still, it took three years before the team was able to conduct a true baseline measurement study. The organization's large size, global distribution and local management culture all required the team to measure fuzzy before they could measure hard.

LESSON 8: Choose speed and specificity over size and generality. At some point, the set of highly spe-

cific and easy-to-access information that has been built to a useful level becomes an unwieldy blob of information that threatens to overload users. For GBP, this transformation occurred somewhere between the first and eighth versions, during which time the content volume increased thirtyfold.

Thirtyfold increases are easier to achieve than one might think. For example, the original development guidelines restricted content to about three pages per best practice. User demand for more details swelled those three pages to 10 or more. Frequent users familiar with GBP software application and content welcomed the additional information. Unfortunately, it had the opposite effect on casual users and in fact converted many casual users into nonusers.

In responding to experienced user requests for more information, the GBP team unwittingly sacrificed speed and specificity for size and generality. While there may be no turning aside the demand for more information in a knowledge base, the method of delivering it might require a customizable software delivery design, especially if usage patterns vary widely across the organization.

Looking Ahead

The GBP development team continues to change not only the way it achieves its goals but also the goals themselves. Few companies have much experience managing their knowledge bases. The goals that are set for these initiatives are based on a very limited understanding of what is truly possible. The team has decided that the best way to reap the benefits of building knowledge is to be the first in the company to see when it is time to use the wrecking ball to knock down the edifice and build the next one. 

Wendi Bukowitz is the director and collaborative research initiative member of the GBP Core Development Team at Arthur Andersen LLP. She can be reached via e-mail at wendi.r.bukowitz@ArthurAndersen.com.

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TAKING YOUR CHANCES

New pressures and higher stakes are forcing companies to rethink how they justify and oversee IT risks

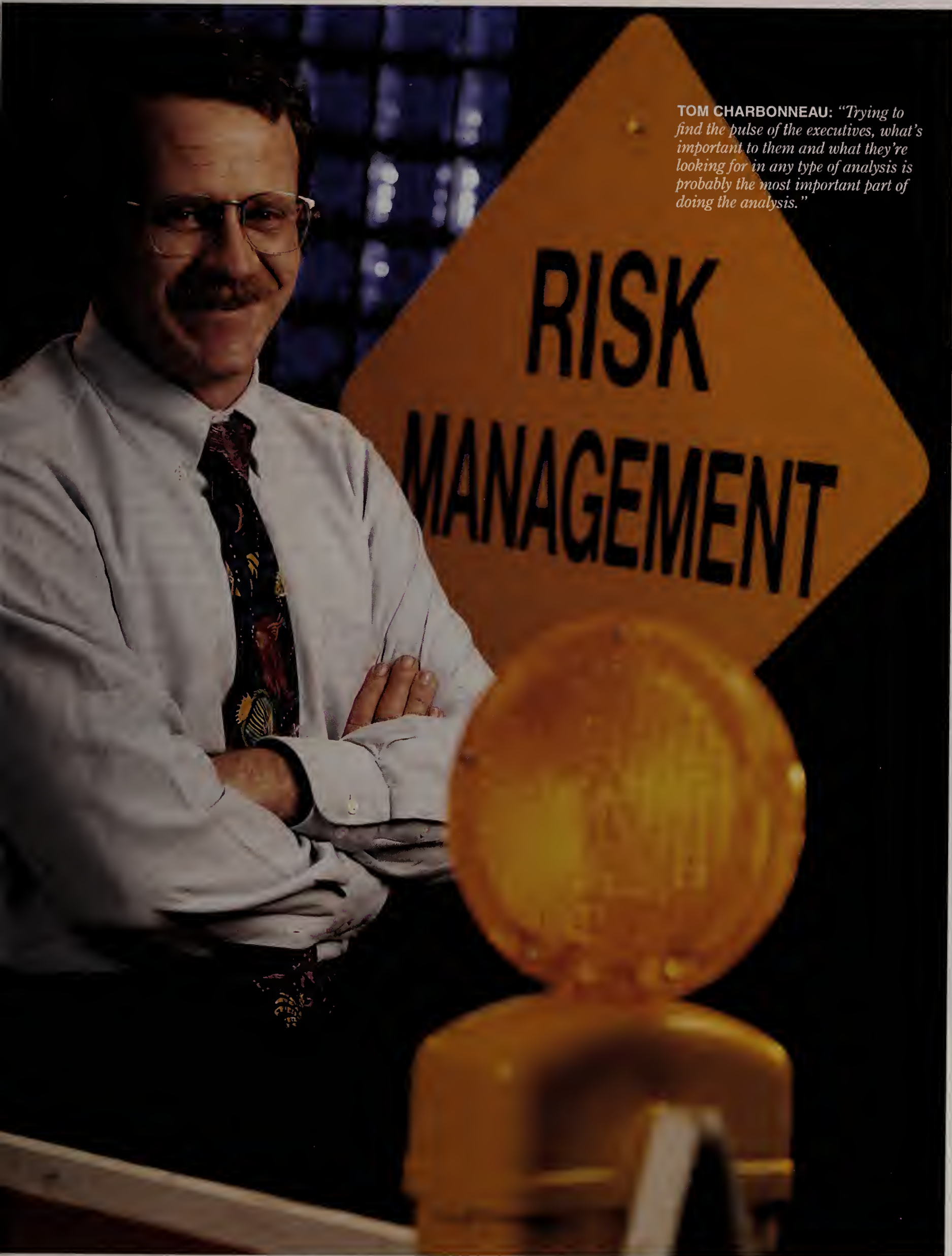
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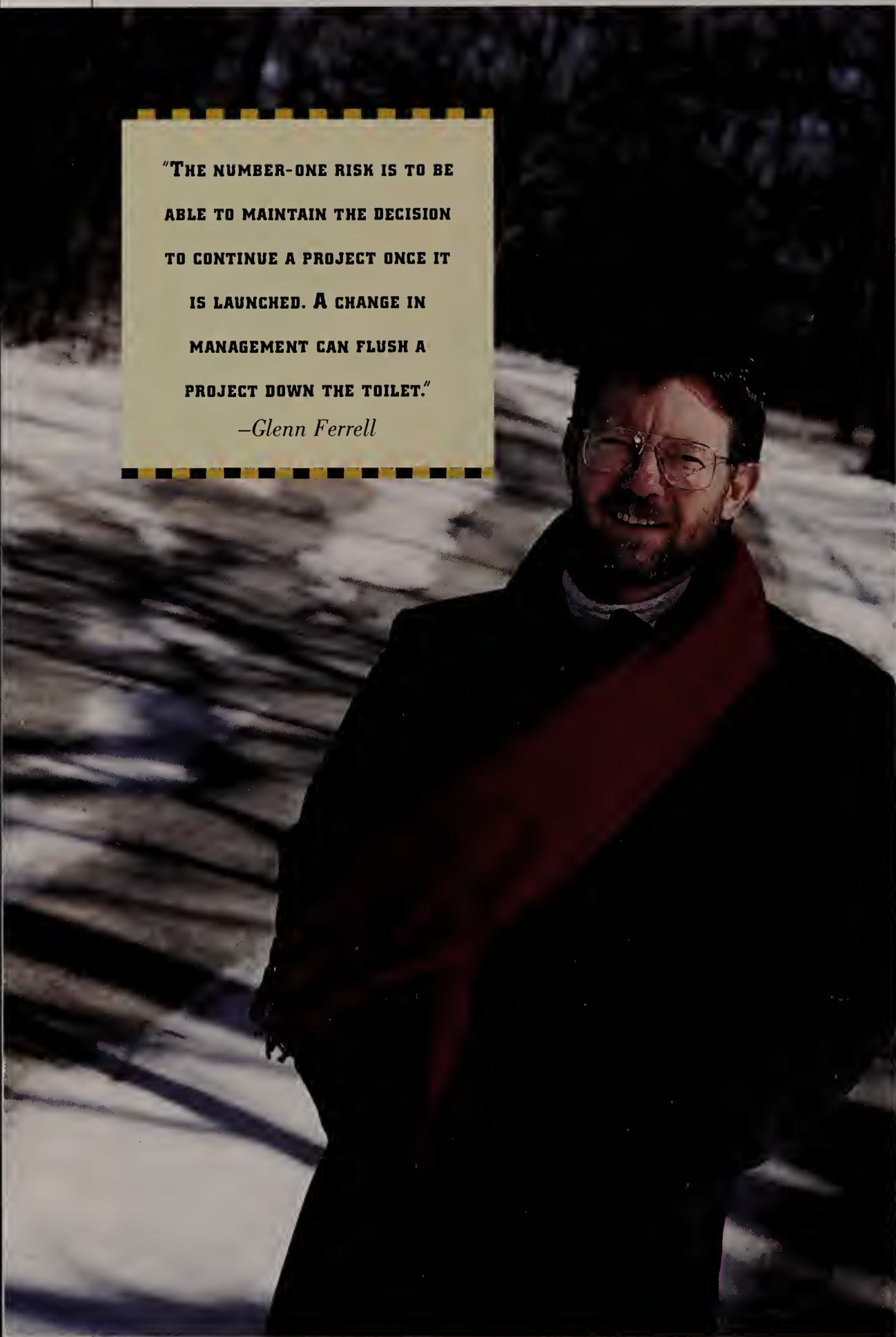
a technology chief break out in hives.

Over budget, behind schedule and increasingly obsolete, a Federal Aviation Administration project to update its air traffic control system was ridiculed on the front page of *The New York Times* in late January as an outrageous waste of taxpayers' money and a textbook case of mismanagement. Originally conceived by the FAA in the early '80s as a way to consolidate its air traffic tracking operations and increase efficiency, the multibillion-dollar Advanced Automation System was billed as a money-saving technofix. Fifteen years later, the FAA has admitted that it wasted about \$500 million on software development for abandoned portions of the project. Moreover, it cannot deliver any tangible improvements to the current system, powered by 25-year-old mainframes, before 1998. Even once the scaled-back upgrade is complete, it will not accommodate satellite technology that has emerged since the project's specs were written. Ironically, the FAA did deliberate the risks of the mammoth project and con-



TOM CHARBONNEAU: *"Trying to find the pulse of the executives, what's important to them and what they're looking for in any type of analysis is probably the most important part of doing the analysis."*

PHOTO BY PATRICK O'CONNOR



**"THE NUMBER-ONE RISK IS TO BE
ABLE TO MAINTAIN THE DECISION
TO CONTINUE A PROJECT ONCE IT
IS LAUNCHED. A CHANGE IN
MANAGEMENT CAN FLUSH A
PROJECT DOWN THE TOILET."**

—Glenn Ferrell

There are as many ways to define risk management as there are ways to botch a project. Some companies rely on a checklist of questions and intuitive judgments to make important calls on projects; others follow their own rigid procedures; a few use formal methodologies. But there does seem to be a fair amount of consensus on the issues that IT executives consider paramount.

Cost Analysis: IS THE PROJECT WORTH THE INVESTMENT?

Risk management begins with the bottom line: cost, savings and potential new revenue. A formal review procedure at printing giant RR Donnelley & Sons Co. in Chicago splits projects into phases and requires approval and a set budget for each stage. In the initial phase, a program team consisting of a program manager, development project manager and managers from marketing, manufacturing, IS, communications and finance present the projected costs and benefits to representatives of the

PHOTO LEFT AND RIGHT BY AVIS MANDEL

Ranking IT Projects

Some business and IT managers analyze risk by assigning numerical values to the risk and reward factors in a project. The risk total is then subtracted from the reward tally to produce an overall "score" for proposed IT investments. Rankings are based on subjective judgments. Typical questions include the following:

RISK FACTORS

Investment Size: How large is the proposed technology investment, especially in comparison with the overall IT budget?

Project Longevity: Do projects adopt a modular approach that combines controlled systems development with rapid prototyping techniques? Are

duct cost-benefit analyses.

Though the case may seem to prove the futility of risk management, this fiasco is actually an excellent argument for the importance—and difficulty—of managing risk well; it demonstrates the risks of assessing risk. Far from an exact science, risk management is an alchemy of common sense, careful analysis, foresight and intuition. IS's increasingly central

role in driving the business, the move toward distributed computing environments and the rapid evolution of technologies are forcing organizations to change the ways they study and manage computer-related risks. Because whether a company is accountable to taxpayers or shareholders, the last thing it can afford is to sink money into failed information systems.

relevant business unit, including the group president and the senior vice president of technology. The decision at that point hinges on the numbers, says Glenn Ferrell, a project manager for Donnelley, although less-concrete contributions are also discussed.

One project Ferrell helped run past that hurdle involved introducing new software and training to increase the productivity of the printer's electronic prepress functions across two business units. Typically, RR Donnelley's customers hand over electronic files of the catalogs, books, directories or other documents they want printed, and RR Donnelley processes those files to generate the materials needed to print. But in many cases, Ferrell says, customers' electronic files contain technical errors that can cause production snafus or printing errors.

The new system was intended to help employees trouble-shoot glitches before they became expensive mistakes later in the process. One key hurdle that a project must pass in the first phase approval is to demonstrate



BRUCE BUKIET (l.) and GLENN FERRELL: As publishing became increasingly electronic, RR Donnelley needed more sophisticated technology to manage graphical data types.

that the Internal Rate of Return (IRR) of the project will meet or exceed a set level. That standard is based on a number of criteria that account for the cost of equity and the cost of debt, including measures such as the 30-year bond rate and company's stock

performance. The proposed system, which then had a projected return of between 30 percent and 100 percent within three years, more than passed the threshold the company had set at the time, Ferrell says. "That was what made the project fly—it was not expensive, and it had a good return," he says. "The process is focused on cost all the way through."

Opportunity Lost: THE RISK OF INACTION OR FAILURE

But risk management often goes beyond a straightforward cost-benefit analysis to weigh the cost of *not* launching a project or of failing in the attempt. Roughly one-third of large companies have altered their IT analysis methods since the late 1980s to include some kind of assessment that balances risks with strategic returns, according to David Shpilberg, director of information technology consulting at Ernst & Young LLP in New York.

Many companies, including Shpilberg's clients, have shifted to a strategic risk-adjusted rate of return evaluation for IT investments. Risk-adjusted returns weigh the hard-to-measure strategic benefits of two or more proposed systems against the costs of not achieving the desired goals. For example, a customer service system might allow representatives to provide clients with information faster and thereby retain customers whose business is worth a specified amount. Based on tests and prototyping, the company estimates the probability that the system won't work and the negative impact that failure would have on business. Those amounts are subtracted from the expected benefit. One system may offer high rewards but also have high risks, which makes it a middle-of-the-road solution. Another system might not offer such high rewards, but the lower risk deductions make it the better choice, Shpilberg says.

Of course, the numbers that go into the valuations are key, he says, and coming up with meaningful valuations requires a much closer relationship between the IT and busi-

projects as narrow in scope and as brief as possible in duration?

Technical Risks: How will proposed technology be integrated into existing systems? Will proposed investment take advantage of commercial, off-the-shelf software and systems? How will the complexity of the systems architecture and software design affect the development of the project?

REWARDS

Business Impact: How will the technology investment contribute to improvement in organizational performance in specific, outcome-oriented terms?

Customer Needs: How well does the technology investment address identified internal and external customer needs and demands for increased service quality and timeliness or cost reductions?

Return on Investment: Are the re-

turn on investment figures using cost-benefit analysis thresholds reliable and technically sound?

Organizational Impact: How broadly will the technology investment affect the organization (i.e., the number of offices, users, work processes and other systems)?

Expected Improvement: Is the proposed investment being used to support, maintain or enhance existing operational systems and processes (tactical) or designed to improve future capability (strategic)? Is the project required to maintain critical operations—payroll, beneficiary checks, human safety, etc.—at a minimal operating level? What is the expected magnitude of the performance improvement expected from the technology investment?

Source: United States General Accounting Office, Accounting and Information Management Division



JOHN BEREZNY JR.: "If you get burned once, you're more careful."

ness units than may have been required in the past. Even then, as with all models that assign values to aspects of risk and potential benefit, the inputs involve a lot of guesswork (see "Ranking IT Projects," Page 38).

For that reason, though it did invest in prototyping and analysis, The Toro Co. in Bloomington, Minn., didn't employ any formal risk analysis methodologies before investing in a multimillion-dollar integrated business system from SAP America Inc. Because accurately estimating the strategic payoff from an initiative can be impossible, IT leaders must possess more than ever a profound understanding of their company's business and what's driving it, says Gerald T. Knight, vice president of finance and CFO.

"You can analyze it to death numerically," Knight says. "But...whether the numerical payback is 20 percent or 50 percent becomes immaterial. You're talking market share. And you don't know how much market share or how many extra sales you're going to get by putting in the [sales and dis-

tribution] module of SAP. You'll *never* calculate that with any reality. But I *do* know darned well that I'll be able to react to my customers faster and better and more reliably and with a lower cost using the [sales and distribution] module of SAP than with my current system."

Vendor Management: BUYING SMART

Risk management doesn't stop with project approval. Many companies describe the bulk of their risk management concerns as trouble-shooting that takes place once a project begins. That involves focusing on risky elements specific to a particular project and finding ways to minimize the potential for missteps.

CIOs are becoming more adept at negotiating with vendors and managing the resulting contracts. Important factors for IT executives to consider before dealing with a vendor include the vendor's financial health, marketplace performance, reinvestment tendencies, technology directions, cus-

tomor relationships and global capabilities.

Even when a vendor measures favorably against those standards, rampant mergers, takeovers and product discontinuations can leave companies at risk. Managers at Rohm and Haas Co., a \$3.5 billion Philadelphia-based chemical company, learned that lesson the hard way. A large and reputable New England-based software company sold Rohm and Haas an application that enables salespeople to extract client information from a central server to carry with them on the road. The pilot projects were underway, contracts were signed, and Rohm and Haas was ready to roll out the system worldwide when the vendor dropped the product from its line, effectively halting the project. "It left us high and dry," says John Berezny Jr., IT infrastructure, finance and administration manager at Rohm and Haas.

Because of risks like these, Berezny has always made certain that all contracts stipulate what happens in the event of product cancellation or a buyout. For instance, he negotiates contracts so that his company retains

"WHAT WE CAN DO IS PUT IN PLACE

A SYSTEMATIC FRAMEWORK

FOR THINKING ABOUT

THE UNCERTAINTY OF THE WORLD."

—John Henderson

rights to source code in case of product cancellation, and he puts money in escrow until a project is completed. Also, he details contractual assurances that any future purchaser of the product or vendor company will honor the contract terms. These conditions have come in handy. Rohm and Haas has many programs it bought from other vendors that were later purchased by Computer Associates International Inc. CA is obliged to honor the original contract terms and conditions. "If you get burned once, you're more careful," Berezny says.

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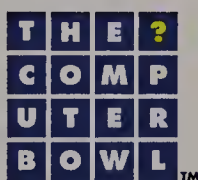
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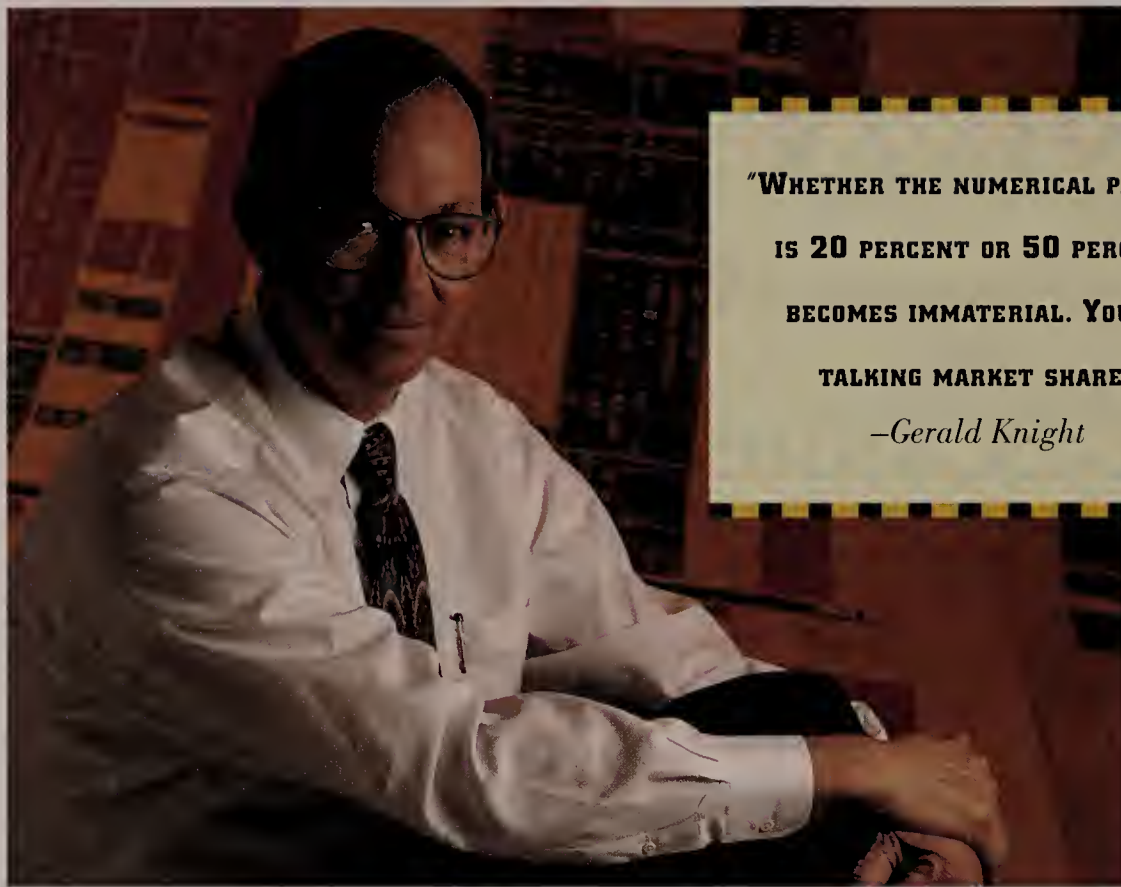
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**"WHETHER THE NUMERICAL PAYBACK
IS 20 PERCENT OR 50 PERCENT
BECOMES IMMATERIAL. YOU'RE
TALKING MARKET SHARE."**

—Gerald Knight

For some, keeping alternatives open until the last minute during the IT investment process reduces risk. While it's not unusual to consider several choices in the beginning of a decision-making process, Claude Marais, director of processing services and planning in information services for Elf Atochem North America Inc. in Philadelphia, takes the alternatives mantra further than most. His cardinal rule for managing IT risk for the \$1.7 billion chemicals manufacturer is to negotiate full contracts with at least two vendors before selecting one. That way, the company has leverage to make the vendor assume certain risks. When a company first selects a project and then tries to negotiate a contract, it has "just gone from negotiating to begging because the vendor knows that you are committed to his product, and therefore you don't have a negotiating position anymore," says Marais, who also founded and sits on the Society for Information Management's IT Procurement Working Group.

Development Practices: GETTING IT RIGHT

Because software development accounts for much of a project's relative risk, many IT project managers focus significant attention on methodologies and tactics to manage it. Funda-

mental changes to improve software development success rates include setting clear business objectives, conducting modular projects, shortening development cycles, increasing user involvement and using more off-the-shelf software. (For a full discussion of development best practices, please see "The Science of Software Development," Page 62.)

Like many companies, Rohm and Haas increasingly embraces a buy-versus-build software policy to reduce the risks associated with cus-

tom development. The company even goes so far as to change its business practices to fit the constraints of packaged systems. If the company writes a lot of customized patches to commercial software, it risks having to rewrite them when the vendor upgrades the software, so "we buy a package and put it in vanilla," Berezny says.

RR Donnelley has also wrestled with whether or not to build software with in-house expertise. As book and magazine publishing became increasingly electronic, managers realized they needed something more sophisticated than relational databases to manage graphical data types. The research and development group spent roughly \$500,000 developing a prototype graphics management database using the latest in object-oriented technologies and artificial intelligence. The prototype worked, but the review panel decided not to invest in it because of the high costs associated with custom development, says Bruce Bukiet, a member of RR Donnelley's technical staff. Instead, the units picked a commercial system that already had much of the object technology layers prebuilt. Was the prototype a waste of money?

Contract Risks

Flexibility: What is your ability to reorganize, acquire, divest, and how does it affect your rights to use the software or hardware?

Forward Compatibility: What will it cost you to move into future technologies, new operating systems, hardware, new versions of the same software?

Third-Party Costs: What does the contract say about the vendor passing costs on to you? In some cases, vendors may not even own much of the code that they're sell-

ing to you. As they continue to develop their product, will they be acquiring the rights to other software? How will they deal with that acquisition cost?

Upgrades: How frequently does the vendor force you to move to new versions of the software? Ensure you have the flexibility to implement or ignore new functionality depending on your needs.

Acquisitions: If possible, specify in contracts what your rights are in the event that the vendor is acquired by another company.

Source: Claude Marais, director of processing services and planning in information services at Elf Atochem North America Inc.

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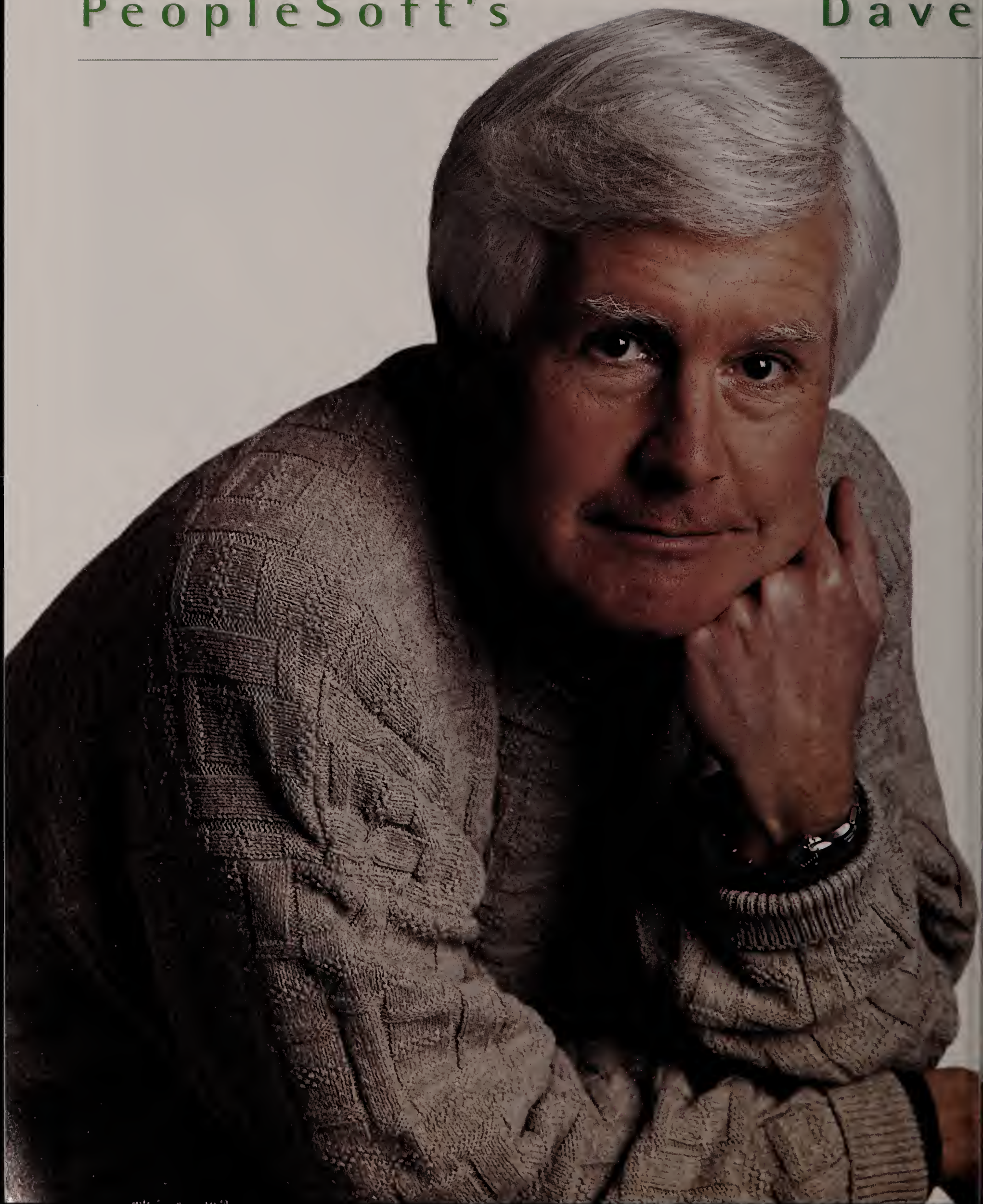
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According to Bukiet, it was a necessary investment to help business unit leaders determine that the custom system wouldn't be cost-effective over time.

In the past, proposed software development didn't go through as much scrutiny as it does with the formal phase approval system. "It was enough that we needed it," Bukiet says. While increased scrutiny "tends to add more bureaucracy and slow things down, it really does give you a good feel for what kind of return to expect." Experienced leadership and constant monitoring are also key to reducing the risk of monumental failures. One result of more stringent monitoring is that companies are pulling the plug on failed projects sooner, says Jim Johnson, president of The Standish Group International Inc. in Dennis, Mass. "In 1996, people will probably write off more projects than in 1995 because they are identifying failing projects quicker," he says.

Political Risk: STUMPING FOR THE PROJECT

Failed equipment, bungled coding, blown deadlines—these are the kinds of straightforward risks CIOs might anticipate. But how much are projects threatened if CIOs do not get buy-in from peers or supervisors? If they miscommunicate the business goals of the project to the IT staff? From the initial investment choice to pulling the plug, a key part of risk management is asking questions, listening, learning and communicating. (See "Loud & Clear," Page 56.)

Just ask Tom Charbonneau. A few years ago, his job of assessing new computer systems at Bose Corp., an audio equipment manufacturer in Framingham, Mass., was fairly prosaic. A system typically automated a single functional area, so its effects were relatively limited. Justifying the system involved calculating an internal rate of return based on reducing some labor costs or getting rid of some equipment. "It was no big deal," says Charbonneau, Bose's manager of corporate information services, business operations and analysis.

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—Jim Johnson

Now the company is installing an integrated system from SAP that spans functional areas—finance, engineering, manufacturing and human resources—and the globe. The system is expected to give the company strategic benefits, such as the flexibility to adapt more quickly to changing markets, rather than reduced costs. But due to the increased size and importance of the multimillion-dollar investment, Charbonneau had to spend a year working with executives from all the functional areas to determine their particular risk concerns—from network failures to efficiency questions—and putting controls in place to allay their fears. These days, "trying to find the pulse of the executives, what's important to them and what they're looking for in any type of analysis is probably the most important part of doing the analysis," he says. Otherwise, information systems are at risk of being shelved before they even make it out of the conference room.

While Ferrell says he agrees that securing buy-in and priming the appropriate executives is key, he adds that shepherding a project to completion amid evolving politics is the most difficult risk to manage. "The number-one risk is to be able to maintain the decision to continue a project once it is launched," Ferrell says. "A change in management can flush a project down the toilet."

Basically, good management practices and risk management go hand in hand, and good management is hard to synthesize. Making the thousands of large and small judgment calls that separate IT success and failure requires dealing with ambiguity. Even

the experts working on new methodologies say methodologies are only a framework for thinking about issues of risk versus opportunity. "We are not going to discover a formula that deals with the uncertainty of the world," says Boston University School of Management professor John C. Henderson. "What we can do is put in place a systematic framework for thinking about the uncertainty of the world." (See "A Road Map for Risk," Page 49.)

Is risk management working? It's hard for experts to say, because the measure of success is subjective. The Catch-22 of risk management is that a company never knows if it has done it well unless a project fails—and then, as in the case of the FAA, it knows it didn't. Furthermore, as several experts observe, executives are known for their propensity to redefine a project's terms so as to declare the outcome a success.

Still, many CIOs feel that increased awareness of IT risks has helped their companies achieve better results. Since 1985, the Royal Bank of Canada has run every IT project worth more than a few thousand dollars through a risk assessment model, says James C. Grant, Royal Bank's former executive vice president of systems and technology. The assessment method, developed in-house, consists of asking hundreds of questions and assigning risk values to the answers. Grant, now president of consultancy C.G. James and Associates Inc. in Oakville, Ontario, says he ran roughly 240 IT projects at any given time and that 25 percent of them were modified to reduce the risk before they proceeded because assessment showed they were high risk. Because some projects that went ahead failed anyway, quantifying the success of that approach is difficult. But Grant says that while the metrics are subjective, the results are tangible. "I think we had better management that ended up increasing shareholder value." **CIO**

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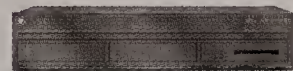
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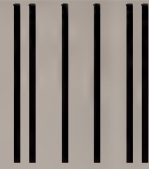
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A ROAD MAP FOR RISK

Methodologies point out paths to success
and paths fraught with peril

BY CAROL HILDEBRAND

ALL CIOs EVENTUALLY FIND themselves at the crossroads of IT investment, faced with multiple options and minimal certainty about the potential outcomes of their choices: Should they go for the SAP implementation that the CEO is so fired up about? The data warehousing project that marketing is rabid to get in gear? The sales support systems with a staggering budget? Tough choices about where to spend precious resources often mean losing opportunities somewhere else. How can CIOs decide which projects will give the company the biggest payoff?

Deciding which projects are opportunities and which are risky business is what keeps CIOs downing the Maalox; for every UPS package tracking system that one-ups rival Federal Express, there's a Denver airport baggage system busily mangling the Samsonite. You can be sure that both of these systems started out as calculated bets that new technology would produce a competitive advantage.

While IS heads might wistfully long for the eeny-meeny-miney-moe approach that worked so well in childhood days, companies are beginning to turn to more structured methodologies to help assess the risk of a particular IS project. The challenge is to translate the strategic worth of a proposal into business language that can then be weighed along with more tangible factors such as hardware and

labor costs. Three methodologies detailed below offer different approaches, but they all emphasize that CIOs can make better decisions when they evaluate a prospective project based on where it fits into both the IT framework and the business strategy. "It gives CIOs a way to think things through and to make a conscious decision," says Mike Villegas, a partner in the computer risk management group of Arthur Andersen LLP in Los Angeles.

Risk Lessons from Options Thinking

Nalin Kulatilaka, a professor of finance at Boston University, says that companies often become frustrated in their efforts to effectively evaluate IT investments because they lack an appropriate context within which to frame the investment process. Kulatilaka's research group, part of the Systems Research Center at the university, has drawn on various theories related to financial options to create a guide for managing IT investments.

Financially speaking, an option is a contract that allows, for example, the purchaser to buy or sell a particular amount of stock at a certain price within a specific time period. Although the purchaser can exercise that option, he or she is not obligated to do so. Thus, the contract builds flexibility into the investment project.

The BU group recommends a methodology that lets business executives exercise what it calls "real options" when evaluating a prospective IT project.

"It's like evaluating derivatives risk portfolios," Kulatilaka says. "Owners can be flexible about changing a deal to avoid losses in bad outcomes and enhance gains in good outcomes."

The methodology first links the project to a company's business vision. Kulatilaka says the usual methods of justifying IT systems—such as calculating ROI or quantifying productivity improvements—do little more than favor projects with quick payback periods at the expense of those with potentially higher returns on assets over a longer period of time. Kulatilaka and his team create a risk profile of the proposed project by building a "tree" of decisions and their possible outcomes along with a probability for each outcome. Thus, says Kulatilaka, the CIO can work with the financial folks to mitigate certain high-risk factors.

For example, one client, a Canadian financial services company, decided to implement an imaging project in stages so that business executives would have several points at which to revisit the risk profile and modify the project accordingly. The first stage went very well, says Kulatilaka, but the mortgage market took a sudden downturn. After factoring that change into the decision tree, the company decided that the project's potential for failure was too high and put the next stage on hold, in essence exercising its option not to continue. Kulatilaka says his group's exercise can help erase the credibility gap that sometimes lies between IS and the rest of the business. "Often a CIO is so concerned with being an advocate for a project that he or she hides the uncertainties of a project," he says. In the case of the Canadian company, not only did the CIO *not* get blamed for bad decision making, but his credibility increased. By translating an IS project into terms of risk and rates of returns, he could speak the same language as the CFO.

Technology and Chaos Theory

Andersen Consulting's interest in risk management proceeded along the lines of that old adage, "Physician, heal thyself." Hugh W. Ryan, a partner at Andersen responsible for architecture, says he began to formulate the methodology about two years ago when the company embarked on an effort to manage its own investment in technology. At the same time, Andersen's clients were asking for a way to identify the safest technology in which to invest. Although the prospect sounded promising, it proved unworkable. The problem, he says, is that the complexity of the technology

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WITH BEING AN ADVOCATE FOR A
PROJECT THAT HE OR SHE HIDES THE
UNCERTAINTIES OF A PROJECT."**

—Nalin Kulatilaka



market thwarts most attempts to successfully predict specific trends.

So Ryan drafted guidelines for the timing of IT investments using a scientific discipline known as chaos theory, which posits that, over time, very small—almost unnoticeable—differences start a chain reaction that eventually brings about big changes. The methodology steers a CIO's decisions by comparing a company's strategic investment

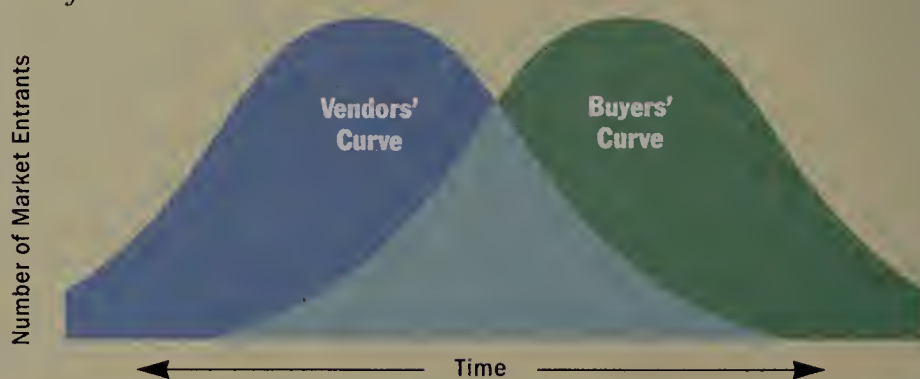
plan with the life cycle of specific technologies. Ryan equates the methodology with looking at the market as an ecosystem. In his white paper "Future Perfect Chaos," he writes: "Competitors are like organisms in a pond, fighting to survive and to become dominant. In this environment, small advantages (for example, the ability to survive in slightly colder temperatures) result in long-term dominance."

Andersen has captured this ecosystem in two bell curves (see chart below) that show the interplay between technology's two life cycles—vendor development and buyer acceptance. The first bell curve shows the evolution of the vendors in a given market over time, progressing from a startup phase that has many competitors to a chaotic middle period when they duke it out for market dominance and then to a simplification period when one or two market leaders succeed at managing a technical lock-in by winning significant market share.

A similar bell curve, borrowed from Geoffrey Moore's *Crossing the Chasm: Marketing and Selling Technical Products to Mainstream*

Buyers and Vendors: Marketplace Behavior

Vendor development and buyer acceptance overlap in the marketplace. Early purchases close to the high point of the chaotic vendor market should focus on short-term returns. Later purchases of more-stable technology should be geared toward long-term benefits.



SOURCE: HUGH RYAN, ANDERSEN CONSULTING, 12/95



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Customers (HarperBusiness, 1991), charts the buyer's rate of acceptance of each technology, from visionaries who quickly embrace cutting-edge technologies to laggards who wait for mainstream endorsement before they purchase. Once the curves are overlaid, CIOs can look at the state of a given technology's market and see if its current situation meshes well with their particular implementation style.

For example, early users of technology face such risks as unforeseen problems caused by a lack of hands-on implementation experience, the likelihood that a chosen vendor may not survive, sudden changes in the direction of a technology and difficulties stemming from integrating a new technology. So any projects planned around cutting-edge technology should focus on near-term big returns on the investment; the return should be measured in months, not years, because one can't count on the long-term viability of the technology. "If you're applying technology early in its life cycle, it's hard to find a tangible payback," says Ryan. "Focus less on ROI and more on what business impact the project will have."

Save the architectural approach until the mature period of the technical life cycle when risk factors can be contained by working within a carefully thought-out technical infrastructure. Payback in this period will be longer term and focused on percentage returns. The intermediate period of a technical life cycle is what Ryan calls the "sweet spot" of technology investment where a company can still build a significant strategic edge before others do, and with technology that's relatively mature.

Software to Manage Business Risk

It sounds like shrink-wrapped heaven—software to answer all those implementation questions that bedevil a CIO: "Should I build or buy software for that project? How do I plan this project to come in on time and under budget? How many programmers should I account for in this project budget?" But NorthPoint Software Ventures Inc.'s risk assessment applications ask users some pretty tough questions before they deliver a divine solution.

The reason, says CEO David L. Chapman, is that many companies evaluate the risks of a prospective project in purely technological terms: which vendors to choose, what network backbone to install, etc. But his research shows that in terms of the total risk involved in a project, selecting poor technology repre-

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—Hugh Ryan



sents only 15 to 16 percent. By contrast, poor marketing accounts for 45 percent and poor management represents 60 percent. (Percentages add up to more than 100 because some risk factors count in more than one category.) That's why Chapman's Framingham, Mass.-based company offers a more integrated approach. "Our tools are really a business management tool," he says.

NorthPoint's TechKnowledge family of tools draws on a database of product development studies from 300 companies and more than 500 in-

dustry- or market-based variables to come up with what Chapman calls the "risk index" of a particular project. For example, one section of the model asks if the company has developed a business case for the project. Although it may be easy to answer yes, the model then defines "business case" in terms of specific steps. The point is to gather as much information as possible. "When you say business model, people take it for granted that everybody knows what one is, but in fact [models] vary significantly from one company to the next. Our tool has components of such a model, so people can plan better," he says.

The whole point of the methodology is to discover internal knowledge resources from which the company can draw, Chapman adds. That way, instead of concentrating only on time-driven events such as project deadlines, managers can assess whether they have the knowledge to meet those deadlines. By pinpointing these "knowledge gaps," a CIO could, for example, decide to buy certain software rather than develop it internally. "The less knowledge you have, the more likely you are to underestimate your project," warns Chapman.

The tools also provide a wealth of data in a language that financial types can understand, and can help CIOs more accurately gauge the scope of a project. "Generally, people get projects funded based on connections, or their communication skills," says NorthPoint Partner Brenda J. Schone. "This software helps people figure out what the real benefits are in a language they can understand." In the end, although knowledge cannot guarantee a perfect project, it can edge a company closer to success. Says Chapman, "Knowledge is the most competitive tool you have, and that's what you should be focusing on." **CIO**

Senior Writer Carol Hildebrand may be reached at cjh@cio.com.



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According to one management expert, the greatest threat to the success of any IS project is a failure to communicate

BY CAROL HILDEBRAND

I**T'S HARDLY ROCKET SCIENCE:** Any experienced project manager can tell you that the bigger the IT venture, the higher the risk. After all, the potential for technical difficulties typically increases with the size of a project. Moreover, the administrative duties required to manage a large-scale effort are more complex than those required for only several people.

Managers of projects that involve many hundreds of team members spend much of their time both planning and trouble-shooting myriad technical and logistical details. Unfortunately, that's not where the majority of the risk lies, according to Erwin Martinez, a partner at Computer Sciences Corp. (CSC) in San Francisco. As a result, he says, project leaders would be wise to focus more on customizing their communication style to meet the needs of the team, especially when faced with a massive implementation effort. Martinez has been involved in systems development for almost 20 years, having spent the last 12 managing large-scale information technology projects. Senior Writer Carol Hildebrand spoke with him recently about how IS managers can rein in communication risks.

Erwin **MARTINEZ**

Project leaders are wise to customize their communication styles to meet the needs of the team.



CIO: *What's the main difference between large and small technology project implementations?*

MARTINEZ: Nothing ever gets simpler as it gets bigger. But when it comes to communicating, there's a particularly steep complexity curve. As the size of a project grows, there is a nonlinear increase in the complexity of project communication. You can't just vaguely communicate facts to a small set of team members and expect the facts to naturally disseminate among the rest of the group. You have to learn how to communicate quite explicitly.

CIO: *Why can't you send an e-mail to a team of 100 people just as you would a team of five?*

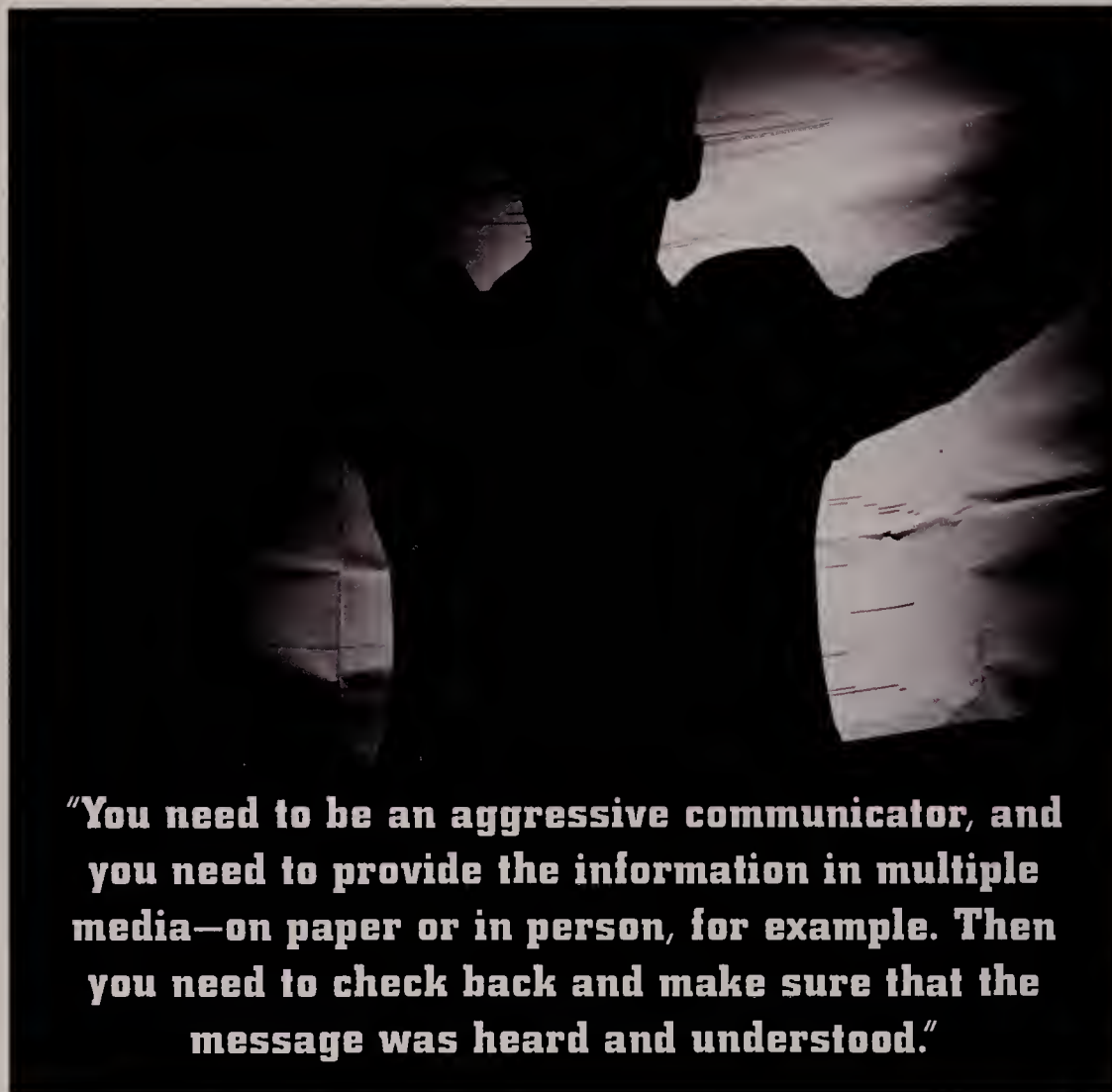
MARTINEZ: As a group increases in size, you have a whole slew of management challenges. Communicating badly exponentially increases the possibility of making fatal mistakes. A large-scale project has a lot of moving parts, which makes it that much easier to break down. Communication is the oil that keeps everything working properly.

Many project managers fail to realize that the techniques that work for a small project can't necessarily be scaled up for a large-scale implementation.

In a simple example, it's much easier to address an atmosphere of distrust among a group of five team members than it is with a team of 500 members. To quantify the complexity, think of it this way: A five-person project has 120 possible communication combinations. A project with 100 team members is 20 times bigger in terms of team members, but it's astronomically more complex in terms of communicating. Add to that the fact that most large systems have multiple sites and are implemented in phases, and you have even more complications.

CIO: *What kind of a project manager could untangle this communication snarl?*

MARTINEZ: With large-scale projects, it's best not to think only in terms of one project manager. I use a model made up of four sets of activities when assessing large-scale projects. The first activity is task management and control. Next comes managing relationships and communication among team members, followed by managing application and solution design and, finally, managing logistics and administration. When you think of those four areas, you realize that generally there are four different types of people, each of whom is good at one of those things, and it's hard to find one person who's good at all of them. If you're the project manager, and you're most comfortable with technical issues—as is the bias for many IS folks—you're going to be the project manager from a technical perspective, and you'll fill your 12-hour day mainly with technical issues. You may be a very good technical architect, but you might also be a very bad relationship manager.



"You need to be an aggressive communicator, and you need to provide the information in multiple media—on paper or in person, for example. Then you need to check back and make sure that the message was heard and understood."

CIO: *How can a project manager avoid that natural bias?*

MARTINEZ: They need to look at the project from a holistic point of view and, to do that, they must first become conversant with their own strengths and weaknesses so that they can delegate properly. It's tempting to do mostly what you like to do best, but if you do not pay attention to all four areas that I mentioned, the project will go badly.

I do quality assurance reviews of many large projects, and I can tell the particular biases of a project manager fairly quickly. If he or she comes in talking about putting together a weekly interface meeting with users or that a survey told him or her just what the team members and users are thinking, I've got a project manager with a bias toward relationship management. If he or she talks about the clarity of the technical specifications or the team's elegant programming, I've got one with a technical bias.

CIO: *What are the hallmarks of a good relationship manager?*

MARTINEZ: There's almost an art to it. You really have to care about people and take a real interest in effective communication or it becomes perfunctory. Good communication can be very fragile, and the set of people who are good at relationship management tend to understand how delicate things can be. You need to be an aggressive communicator, and you need to provide the information in multiple media—on paper or in person, for example. Then you need to check back and make sure that the message was heard and understood.

It's almost a complete loop; you must be heard, and you have to find ways of verifying that you have been heard. If you have this skill, you'll be formulating a plan to address both external and internal project communication needs; you'll be thinking about how different team members prefer to receive and send information, and how to best disseminate it.

For example, people who prefer face-to-face contact would probably rather have a weekly debriefing than get a memo. If you don't have a bent toward relationship management, you'll be wondering why the users are unhappy; after all, you sent them an e-mail about the project only three weeks ago.

CIO: *So how do you get 300 team members, 500 users and 200 back-office employees in one place?*

MARTINEZ: When you want to communicate something to an entire project team—the management team has

made a big decision, for example, or the CEO wants to give a pep talk to the whole team—it's nearly impossible to do if the team and its major constituencies number in the thousands. I was on one project where the solution was to rent a large auditorium at a nearby museum. But whether it's a museum or the neighborhood movie theater, you have to get the whole team together to hear certain big things. Everybody must understand the strategic importance of the project; having all those people hear the same message increases the chance of that happening. The bottom line is, you can't just ignore the need because the largest room in your company seats only 80 people.

CIO: *What about day-to-day information? You can hardly rent a hall every week.*

MARTINEZ: That's where I advocate the "headline news" approach. When you communicate a common message to all interested constituencies, you want the message to be consistent. In a large project, when people don't have an enormous amount of time, you need to condense the news down to its essence for the majority of the team. Consider creating a weekly videotape that operates the same way as CNN's *Headline News*. If CNN can update us on world events in 30 minutes, you can probably give your team members the project news in 10 minutes.

CIO: *But are these sound-bite updates enough to keep the team aware of the project in its entirety?*

MARTINEZ: No. A project manager also needs to provide

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"If you're a project manager most comfortable with technical issues—as is the bias for many IS folks—you're going to be the project manager from a technical perspective, and you'll fill your 12-hour day mainly with technical issues. You may be a very good technical architect but a very bad relationship manager."

periodic opportunities for team members to take a look at the big picture. Any large project is going to be complex. It's an animal with many features, and it can be difficult to understand its totality while under development. There's a video called "The Four-Hour House," where people undertook a challenge to build a house in four hours. It required a tremendous amount of planning, but they did it. The thing is, if you come into the video in the middle of construction, you don't know what the heck those workers are doing. It looks like utter chaos. The same thing happens when you walk into the middle of a very large project because the underlying planning structure is invisible. So project managers may need to step back periodically and run a project conference, with information booths and presentations. If you have 12 parts of the project, I suggest you create 12 different booths explaining the different parts and one that ties the whole thing together. Otherwise, you run the risk of everybody concentrating on their own specialty at the expense of the big picture.

CIO: *What are the "big picture" issues of successful communication on a larger IT project?*

MARTINEZ: Two things: specialization and delegation. Every large effort has a number of specialists. Usually, the more technical they are, the more they lack communication skills. I would dedicate people to work full time at understanding how to communicate and making sure that it actually happens throughout the project. In a larger project, you have enough at risk and enough of a critical mass in terms of people, so you can justify a separate position dedicated to communication.

CIO: *What about keeping Mahogany Row apprised of activities?*

MARTINEZ: Communicating up the ladder, to senior executives, is a little different. For one thing, project man-

agers are looking for more than clear communication from senior sponsors; they're also looking for leadership, stewardship and advocacy on the part of senior executives. So there's a different aspect to the communication flow. They're much less interested in telling the higher-ups how the system is going to work and getting input on what the system will do than in making sure that the executives have enough information to lead effectively.

One of the real risks of getting disconnected from the executive sponsor is that you may also lose sight of business goals. Every big project is about attaining some strategic business aim. You may be implementing a sales automation support system, but if you forget that the goal is to double sales and expand into a new region, you'll get disconnected.

CIO: *How so?*

MARTINEZ: Look at it this way: Every IS systems project has a hierarchy of goals. You have business goals, then systems goals and project goals. The lower caste of goals must not be completed at the expense of the overarching aims. For example, a project team may have a goal of completing programming on a module by Aug. 1, and they make the deadline by cutting some corners that violate certain larger system requirements dictated by business goals. What is the point of meeting the immediate deadline if, as a result, performance stinks and the module doesn't satisfy business requirements? This is a real chance for miscommunication between the technical and business people. You can talk about smaller project goals to senior executives, but they must be couched within the framework of how the smaller issue will impact the business goals that drive the project. Project managers must always keep one eye on the big picture and the other on the details. **CIO**

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The Science of Software Development

BY MICKEY WILLIAMSON



Faced with shrinking cycle times and the threat of outsourcing, more companies are turning the dark art of software development into a science. This transformation includes instituting formal methodologies,

seeking out the best of best practices and benchmarking progress against established models of excellence.

Increasingly beleaguered CIOs are scrutinizing the practices of their application development groups—and finding them wanting. That conclusion is especially alarming in an environment in which timely development is more critical than it has ever been before. For development groups, it's a matter of survival, according to Roger Pressman, president of R.S. Pressman & Associates Inc., a software engineering consulting firm in Orange, Conn. "Outsourcing is becoming a lever to stimulate change," he says. "People today are no longer under the illusion—and it was always an illusion—that IS departments are indispensable and that, therefore, no matter how they operate, they are immune to layoffs, outsourcing and downsizing."

Now that threats to the status quo have snared the IS group's attention, many organizations are seeking to identify and implement the best available practices in software development and comparing themselves with established models of excellence.

The Software Engineering Institute (SEI) at Carnegie Mellon University in Pittsburgh has developed one of the best-known models for software development practices. Its Maturity Model for Software grades organizations on a five-step scale (see chart, Page 64). At the often-chaotic level one, every project is a whole new ballgame. At level five, processes are predictable and controlled and undergo continuous improvement.



F I E O L E R

In a September 1995 SEI assessment of 440 organizations, over 70 percent were still at level one, whereas a mere 1 percent had reached level four (where software quality and development processes are managed). Only one organization had reached the nirvana of level five (for a profile of a level-five

organization, see "Out-of-this-World Software," *CIO*, Feb. 15, 1995).

There are other indications that the average IS organization does not rate highly on the development front. Capers Jones, chairman of Software Productivity Research Inc. (SPR), a software developer in Burlington, Mass., has gathered data on the most outstanding successes and the most dismal failures in six industry categories: systems software, which controls physical devices such as computers or telephones; military software; information systems produced for internal use in business; outsourced or contract software; commercial software created for sale in the marketplace; and end-user software built by nonprogrammers for their own use. (Jones reports his findings in a new book, *Patterns of Software Systems Failure and Success*, published by International Thomson Publishing, 1996.)

"The information systems community tends to have one of the worst track records of any industry segment in terms of the relative proportions of failures and successes," writes Jones. Indeed, when it comes to building large application systems, IS shops fail more often than they succeed, despite the fact that IS techniques for gathering requirements are the most sophisticated of any industry segment.

One reason for the high rate of failure among IS shops, Jones says, is the high rate of "creep" in project scope due to changing user requirements. That view is shared by Jerrold M. Grochow, chief technology officer and director of the Center for Advanced Technologies at American Management Systems Inc. (AMS) in Fairfax, Va., whose company not only consults with IS organizations but also serves as a contract developer to corporations and government agencies.

"More projects have failed because of scope creep than any other management problem," Grochow says. As an antidote, AMS has developed a project manager's handbook, which Grochow calls "one of our best practices. It tells managers to gather in one place all the information related to the project, including the contract and any modifications that have been made. If they have that kind of information at their fingertips, they can avoid many problems, particularly those related to scope creep."

Adopting a formal development methodology and integrating it with process and project management technology can significantly improve the software development process,

Maturity Model For Software

Level 1 AD HOC: There is no development methodology, and few, if any, controls are in place. Progress, even if attainable, may not be recognized because of lack of measurement.

Level 2 REPEATABLE: A set of tasks and processes have been defined well enough to allow one to predict project results with reasonable accuracy; however, no method of forecasting improvements or making trade-offs is implemented.

Level 3 DEFINED: The development process is both implemented and understood. Measurements are taken, and the process is predictable enough to allow one to forecast the effect of implementing new technologies.

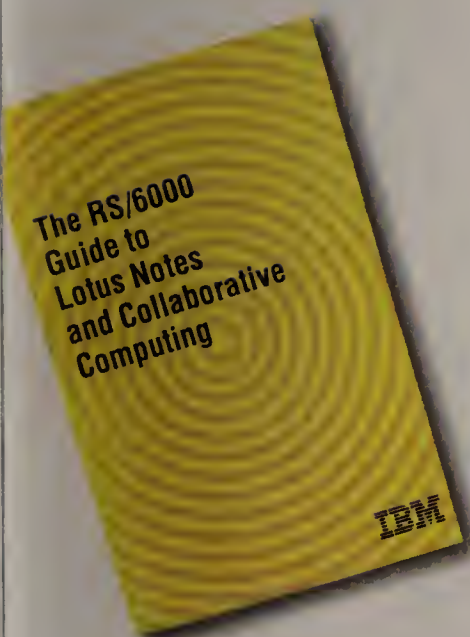
Level 4 MANAGED: Significant quantitative and qualitative improvements are possible because the process itself is managed and evolutionary. Each technology implementation is part of an overall architecture.

Level 5 OPTIMIZED: This is a theoretical level in the development organization where the environment drives the process. Effort can be channeled into improving the process rather than executing it.

It's Lonely at the Top
A survey of 440 organizations reveals that most have not moved beyond Level 1



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"The information systems community tends to have one of the worst track records of any industry segment in terms of the relative proportions of failures and successes."

—Capers Jones



says Brendan Conway, research director with Gartner Group Inc. in Stamford, Conn. (for more on that topic, see the "Gartner View" column in the May 15 issue of *CIO*). Getting control of the development process so that it need not be reinvented for each new project is the goal of level two, the "repeatable" stage of the SEI model.

But a slavish adherence to methodology is not the answer, asserts Grochow. "In our procedure books, there's a very strong caveat that says this is not a cookbook that you follow step by step without applying judgment." He tells junior consultants at AMS that "the trick to being a good manager is knowing when things should be done the same way and knowing when they should be handled differently."

David Zubrow, who heads the software engineering measurement and analysis group at the SEI, worries about the

use of the term "best practices" to describe these techniques. He's concerned that once developers have found their own best practices, they'll no longer strive to improve. "There is always room for improvement," says Zubrow. "You don't want to become complacent." Nonetheless, IS shops can use a number of techniques to better their development efforts:

Time Boxing

Bringing users into the development process has been a double-edged sword. Techniques such as joint application design (in which managers, users and developers jointly hammer out a new application's features and functions) and iterative development (in which feedback is solicited through the course of a project) have helped produce systems that are more business-focused, but they also have opened the door to escalating user requests for more features—the dreaded scope creep. To get these demands under control, many managers are adopting a technique known as "time boxing," in which large projects are broken down into small steps, each with a specific deadline. "When the time box

ends, that's it," Conway explains. "You deliver what you have and move on to the next step." Not only does time boxing focus the efforts of the development team, it also helps mitigate scope creep, he says.

Usability Goals

Even before development begins, goals must be established for the system's "usability." For example, will the system be implemented to a large user base without training, or will users be expected to read a 100-page manual before they put their hands on the keyboard? "Establishing the goal, designing the user interface to meet that goal and then bringing in users to test the usability against the goal are important best practices in development," Grochow says.

The Quality Process

Quality control, of which testing is a part, is likely to be a most fertile area for the institution of best practices in the IS department, according to most observers. Numerous studies have shown that the sooner errors are found, the less costly they are to correct. Too often, developers wait until an application is nearly complete before they show it to those who will use it, thus depriving themselves of critical information that could help them avoid expensive errors.

Zubrow advocates software inspections, referred to as walk-throughs or peer reviews, to help prevent errors from persisting until the software is built and sent for testing. People can spot errors in business logic and misunderstandings of requirements that a compiler is likely to miss. "If you're not doing inspections, you should be," Zubrow says.

CIOs would be horrified if they knew how often "corrected" errors have been reintroduced because of a lack of version control and configuration management (for an in-depth look at CM, please see "Go Configure," *CIO*, Nov. 15, 1995). Automating these two functions also provides managers information about reported defects and problems and the progress made toward fixing them.

Reusable Components

An entire industry is growing around the notion of developing chunks of software that can be snapped together to build application systems in much the same way that automobiles are assembled using manufactured components. But not all components are purchased from outside sources. At Zurich Canada Insurance Co. in Toronto, Nina Babi-

rad, director of customer service systems, presides over a 20-member group that is building key business objects, such as tax calculators and customer information modules, for a new billing system.

"Component-based development is the way to go if we are to maintain [our systems] for the long term and exchange application components among our 80 companies worldwide," Babirad says. Time to market was the motivator at Zurich Canada—the ability to deliver to IS's internal customers the tools for assembling new products and services as needed. Other benefits, says Babirad, include "the ability to be flexible and to modify components without unraveling the entire [application] architecture."

Some companies are borrowing the clean-room techniques of semiconductor manufacturing for component development, building and testing components in a separate facility "so that they can be used as component parts with a high degree of certainty that they will function according to the specs," says Grochow. Such testing involves verification that the software is mathematically correct and validation that it does what needs to be done. Only when clean-room-built components have passed tests in both categories are they released to the developers.

Metrics and Estimates

Monitoring the ratio of defects found and corrected before system delivery to defects reported by users after delivery is another practice that fosters improvement. Gartner Group's Conway suggests collecting other development metrics as well, including productivity improvements from one project to the next and the success of initiated process improvements. "There is no way to improve a process without measuring it," he says. Without a starting baseline and metrics, a plan for improvement is meaningless. Zubrow adds, "If you don't know where you are, a map won't help."

Faulty estimates of personnel requirements, costs and timing negatively affect the best of best practices as well. Conway suggests "triangulating" estimates as much as possible by doing, for example, one estimate based on past experience in comparable projects, another based on the functionality to be built into the software and a third using a formal estimating technique. "At the end of a project, you need to compare your results with your estimate so that you can refine and calibrate future estimates," he says.

To get a feel for how well these efforts are paying off, CIOs should ask development managers some penetrating questions. Conway suggests a starting point: Look at the application backlog and ask why it's as big as it is, what is being done to reduce it and what is being done to speed the time to market. He also urges CIOs to take a close look at build or buy options to ensure the best choice is being made in every instance.

Grochow's focus in a project review is on

The Habits of Highly Effective Developers



- Prepare three separate time and cost estimates based on past experience, software functionality and a formal estimating technique, and compare actual results with predictions.
- Adopt a standard notation scheme and methodology for design and coding.
- Automate control of the development process and link it to a project-management tool.
- Use joint application design for requirements analysis.
- Practice iterative development and time-boxing.
- Institute a formal change-request process to prevent scope creep.
- Establish centers of excellence—encourage the development of specialists in each development procedure.
- Measure productivity and defect removal.
- Employ component-based development.
- Establish clean-room techniques for component building.
- Institute version control and configuration management.
- Design and test for usability.
- Practice code inspections and walk-throughs.

—M. Williamson

"Most senior managers would be willing to spend a few dollars if they could get applications built in very rapid fashion. The need to adapt to market changes is so great that time-sensitivity outweighs cost-sensitivity."

—Roger Pressman



risk management. He asks project managers to enumerate factors that could delay the project, cause it to fail or create significant cost overruns. "If the project manager knows what those risks are and has a strategy for mitigating them, I feel a lot more comfortable that the project is under control."

The SEI helps companies gain control of their development practices by training them to assess their current procedures, looking for areas that can be improved. Originally conceived as a means of helping U.S. government agencies—particularly the military—evaluate the capabilities of their contractors, the SEI has in recent years expanded its services to the point where commercial and in-house software organizations account for the largest number of self-assessments. The SEI maintains a data-

base of assessment results and best practices, Zubrow says, and tries to disseminate what it learns throughout the software development community. "The SEI's mission is to take good ideas that emerge in the state of the art and transfer them into the state of the practice. We're not trying to push on the ceiling; we're trying to raise the floor."

Stimulating an in-house assessment of this kind is one way an IS executive can inspire the development group to improve its procedures.

In Pressman's view, the goal of all process-improvement efforts should be to increase an organization's ability to deliver high-quality applications on time. These days, coming in within budget is of secondary importance. "Organizations today are much more time-sensitive with regard to software and systems than they are cost-sensitive in the classic sense of the word," he says. "Most senior managers would be willing to spend a few more dollars if they could get applications built in

very rapid fashion. The need to adapt to market changes is so great that time-sensitivity outweighs cost-sensitivity." (To read about organizations that have mastered that challenge, please see "Beat the Clock," *CIO*, Nov. 15, 1995.)

However, CIOs may need to do some marketing on this front. At least one study shows that senior management may not be getting the message. Conway once asked a group of 118 development managers to name the greatest obstacle to instituting a software development methodology. Forty-six percent cited a lack of commitment at the management level, 14 percent blamed a dearth of automated tools and 19 percent pointed to insufficient training. Since only senior management could free up the funds required for tools and training, it is reasonable to put much of the responsibility for the failure of organizations to pursue best development practices at the doors of those who could make it happen. CIOs need to confront this contradiction.

To the extent that money stands in the way, Grochow says, "there's never enough money to do it right the first time. But there's always money to do it right the second time." Yet more and more companies are aspiring to move up the SEI rating scale (between 1990 and 1994, the annual number of reported assessments increased almost 250 percent), and most European countries require ISO 9001 quality certification of would-be business partners. Quality-oriented organizations such as the SEI and the Geneva-based International Standards Organization demonstrate that it costs less in the long run to do it right the first time and show companies how that can be accomplished.

While Jones of Software Productivity Research acknowledges that achieving software excellence is neither easy nor cheap, "if your enterprise is not good at software and your competitors are, then your whole company is at serious risk," he adds. The only way to avoid the expense and difficulty of achieving excellence yourself is to seek a business partner who has already made the investment—in other words, to outsource software development. For those who wish to avoid this eventuality, developing best practices—and adhering to them—is the only answer. **CIO**

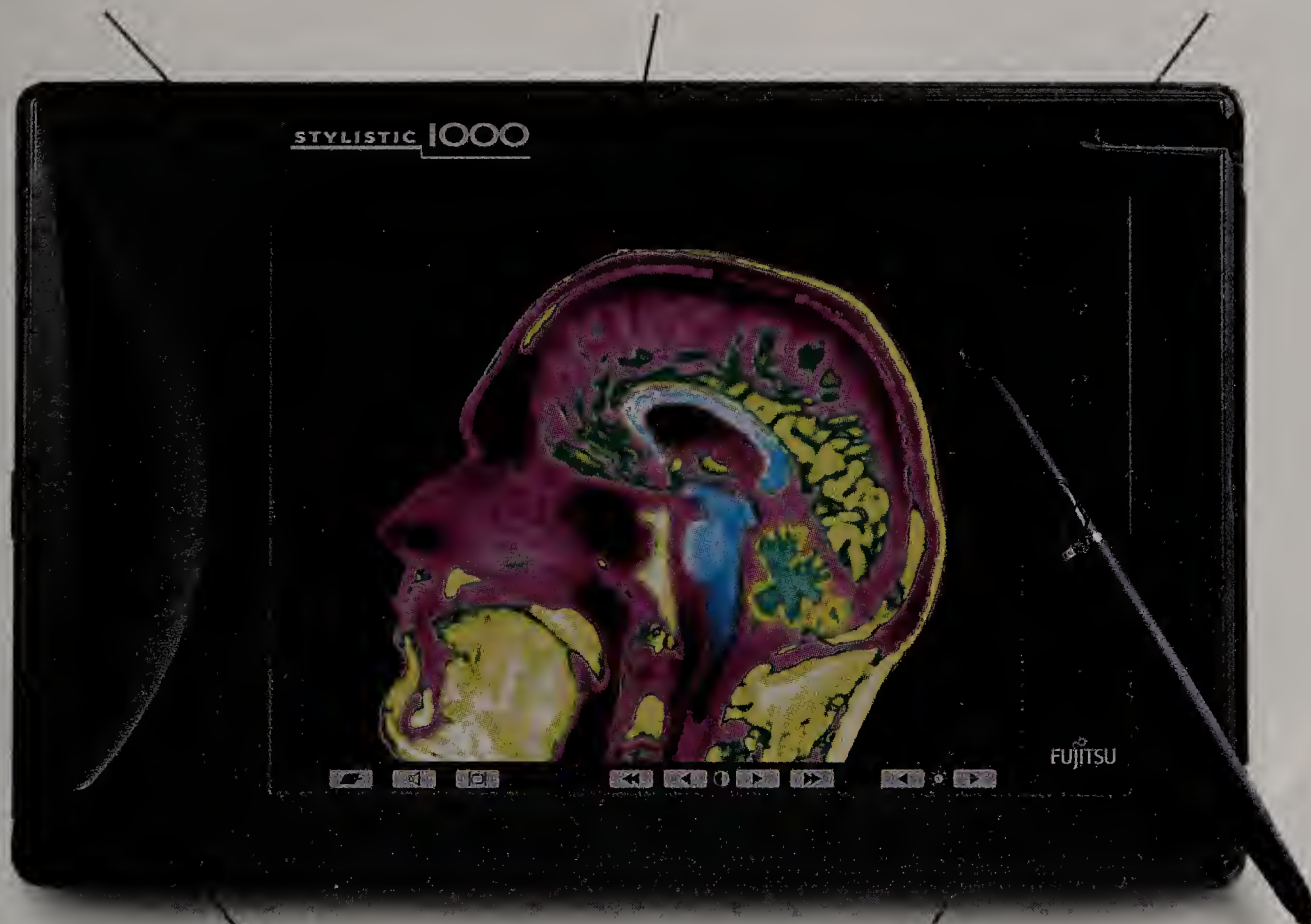
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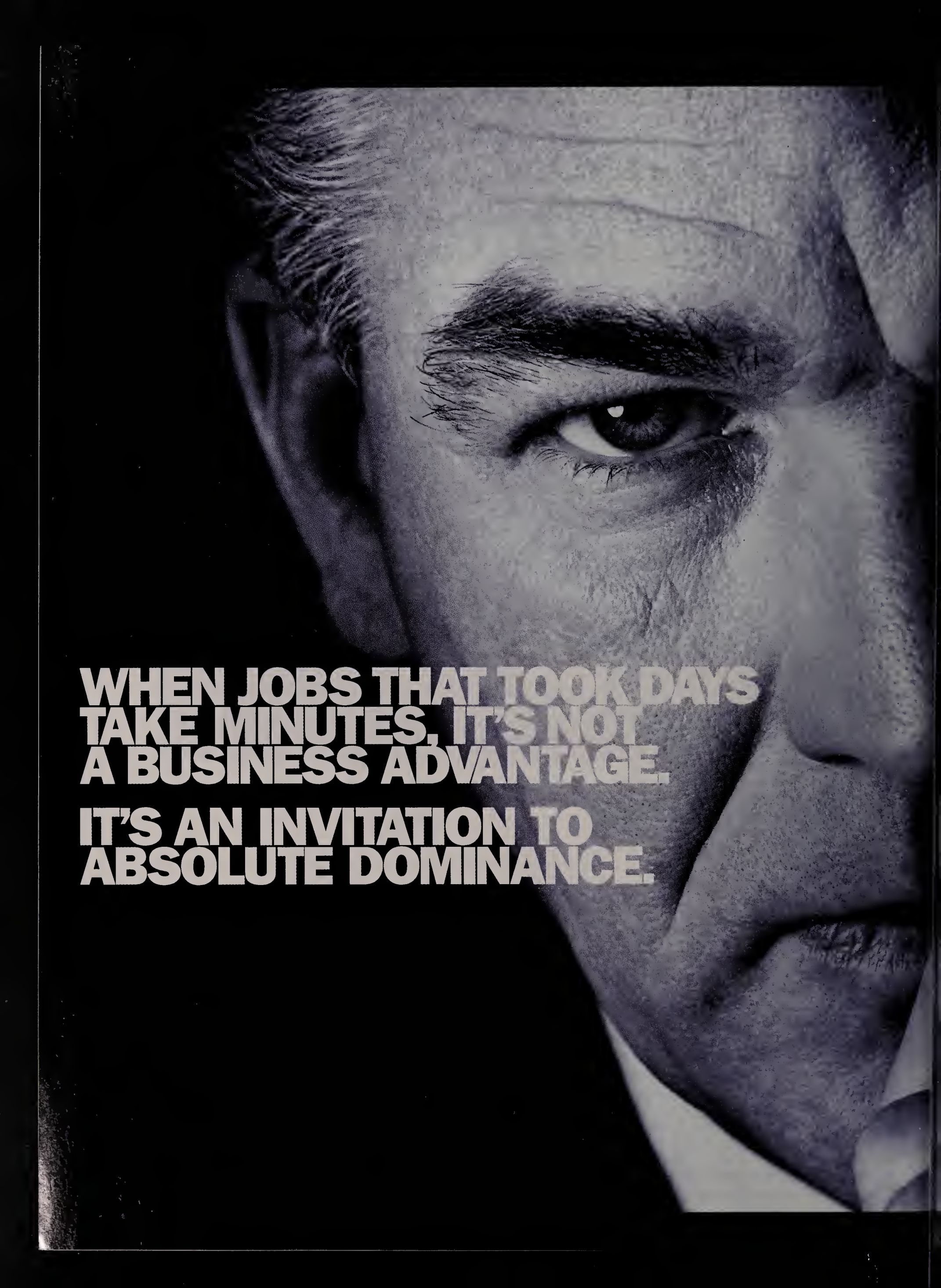
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Gartner View: Client/Server Payoff

*The benefits of client/server projects are many,
but they're not always obvious*

BY KEN DEC

Large client/server projects have a reputation for being overly expensive, labor-intensive and difficult to manage. Some reports indicate that as many as half of all client/server projects fail. But this supposed rate of failure actually reflects disappointment about implementation objectives rather than a true lack of success.

A Gartner Group Inc. worldwide study of 117 large client/server projects that were either fully deployed or actively being implemented revealed that such projects are indeed ugly to implement. Most companies reported that their client/server projects took longer (55 percent), cost more (50 percent) and were more complex (59 percent) than expected. But those very same projects were deemed overwhelmingly rewarding from a larger business perspective. When asked about their projects' results, a large majority claimed success (69 percent), a few said it was too soon to tell (27 percent) and a very few declared outright failure (4 percent). But most revealing was that a whopping 98 percent said they would undertake another client/server project if the opportunity arose. That means even some of the failures were ready and willing to try again.

Cost Confusion

As the client/server model is increasingly applied to mission-critical, enterprisewide business problems, a new reality has emerged that's contrary to the expectations of corporate executives. The expectation is that client/server computing will decrease IT expenditures; when the five-year total cost of ownership is evaluated, however, it turns out that large client/server projects typically cost more than other computing approaches.

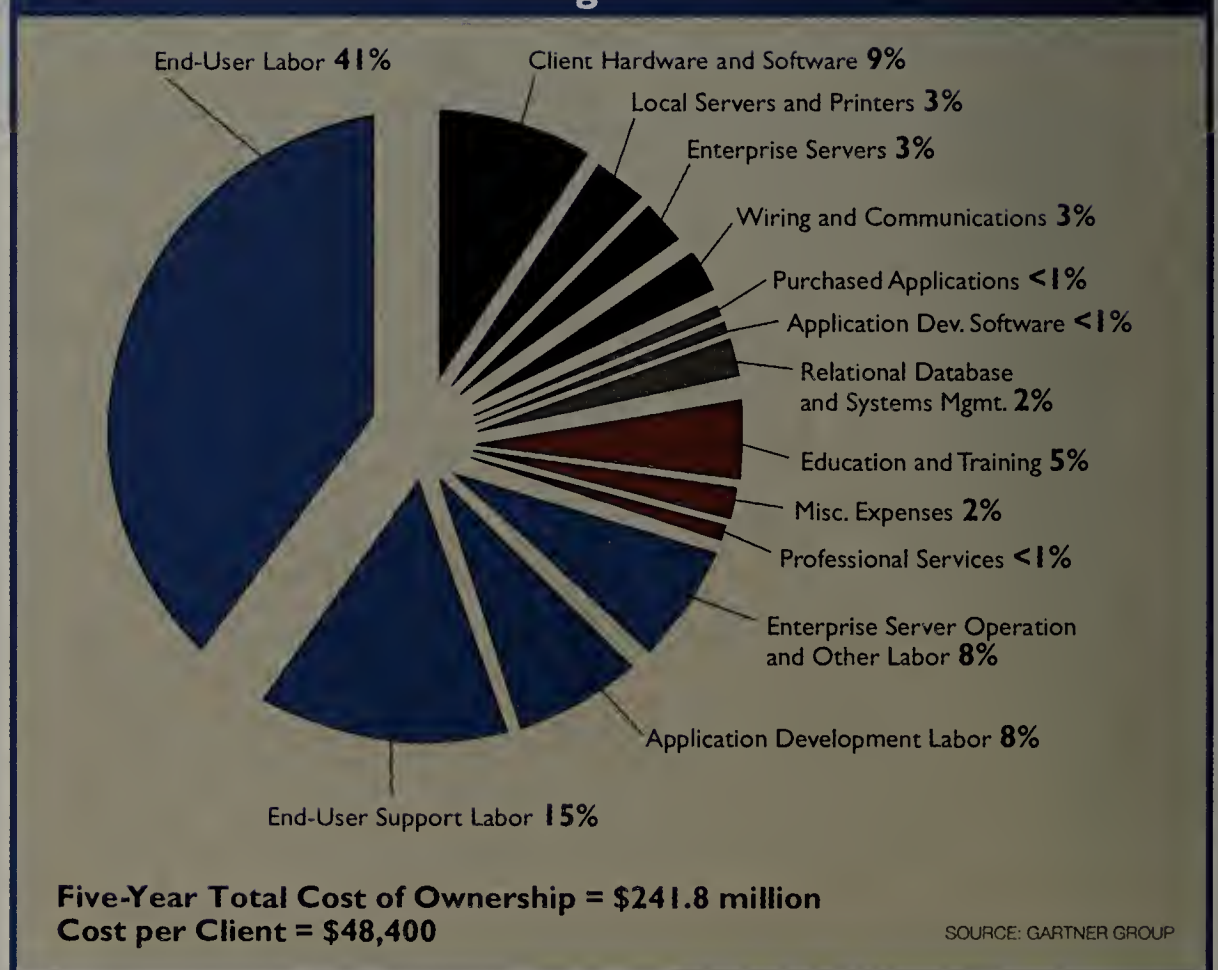
Client/server costs are often underestimated because IS organizations focus on equipment costs, particularly server costs, which are much lower for client/server than for main-

frame computing. If server expense is all management looks at, client/server computing appears less expensive. In reality, only about 5 percent of the total cost of ownership for client/server relates to the server (see Figure 1).

Although the cost for client/server hardware and software is less than that of the equivalent mainframe/terminal technology, much of the hardware and software savings are eliminated by the expense of PCs, whose total cost of ownership is four to five times that of dumb terminals. When the training, management tools, end-user support and end-user labor necessary in a client/server environment are considered, the true magnitude of client/server costs emerges. A Gartner Group analysis of 5,000 client workstations with 250 remote server sites found that client/server computing was 70 percent more expensive than mainframe/terminal computing over a five-year period.

The labor necessary to manage and operate the far

FIGURE 1: Total Cost in a Large Client/Server Environment



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- The extent to which IT was key to achieving the overall business solution—the “couldn't have done it without technology” factor
- The quality of collaboration between the business unit and IS organization that is achieved throughout the course of the project

Each finalist will be subject to an in-depth analysis of the nominated system (to be performed by *CIO* or its agents). This analysis, which may require a site visit, will be based on interviews with sponsoring executives and system users and will be designed to substantiate all claimed benefits. Notification of winners will occur in October 1996. *CIO* reserves the right to publish relevant cost and savings figures that establish the claimed ROI of the system; *the willingness to divulge this information for publication is a condition of entry.*

DEFINING VALUE

We invite applicants to consider the broadest possible spectrum of enterprise value. The following list of IT-enabled benefits is intended to help guide applicants' thinking:

- new, innovative and more productive ways of doing business;
- revamped organizational structures or styles of performing the work of the enterprise;
- the ability of the enterprise to enter a new market;
- successful global operation or expansion;

- transformation of the way the enterprise competes within its customary market or of the terms of competition within the market;
- improvement of the enterprise's relationships with its external customers;
- improvement of the enterprise's relationships with its own employees or among its functions (such as marketing, finance or human resources);
- the ability of the enterprise to compete more effectively by adding to the sum of its available knowledge assets;
- leaner and more economical operations.

ENTRY GUIDELINES

- The system must have been operational prior to July 1, 1994.
- Entrants must agree to be featured, along with their systems and organizations, in a *CIO* article.
- Entries must be complete.
- Entries must be on 8.5-by-11-inch paper, one side per sheet.
- The application form may be reproduced.
- Multiple entries from one company will be considered, but each entry must be submitted separately.
- Entries must be made jointly by the IS executive *AND* the business sponsor for whom the system delivers value.
- IT vendors, public relations and advertising companies, consultants and other third parties may *NOT* apply on behalf of another company. They are encouraged to forward this form to the “owner” of the system, or to contact *CIO* Communications to recommend that an application form be sent to the client.
- All entries must be computer generated or typed; no handwritten entries will be accepted.
- When feasible, an additional copy of the entry should be sent on a 3½ -inch disk. Electronic entries must be limited to word-processing and spreadsheet packages that are compatible with Microsoft Word and Microsoft Excel on a Windows or Macintosh platform.

1. COMPANY/BUSINESS UNIT

▲ NAME OF PARENT COMPANY

CITY, STATE WHERE HEADQUARTERS ARE LOCATED

PUBLICLY OR PRIVATELY HELD?

ANNUAL REVENUES

INDUSTRY

NAME OF BUSINESS UNIT OR ORGANIZATION

CITY, STATE WHERE LOCATED

NUMBER OF EMPLOYEES AT BUSINESS UNIT

2. ENTRANTS

A.

▲ NAME OF ENTERING I.S. EXECUTIVE

TITLE

NAME OF DIVISION, DEPARTMENT OR UNIT

ADDRESS

CITY

STATEZIP

() ()

TELEPHONEFAX

B.

▲ NAME OF ENTERING BUSINESS-UNIT EXECUTIVE

TITLE

NAME OF DIVISION, DEPARTMENT OR UNIT

ADDRESS

CITY

STATEZIP

() ()

TELEPHONEFAX

3. SUPPORTERS

Please list four people who are willing to be interviewed with regard to the system, its development, its use and the value returned. At least one should be a member of the technology team that developed the system and should have played a significant role. At least one should be a primary user from the sponsoring business unit. The other two may be from either organization or represent suppliers, customers or others intimately familiar with the system.

A.

▲ NAME

TITLE

() ()

TELEPHONEFAX

REASON FOR INCLUSION

B.

▲ NAME

TITLE

() ()

TELEPHONEFAX

REASON FOR INCLUSION

C.

▲ NAME

TITLE

() ()

TELEPHONEFAX

REASON FOR INCLUSION

D.

▲ NAME

TITLE

() ()

TELEPHONEFAX

REASON FOR INCLUSION

MAIL TO:

DEADLINE:

JULY 1, 1996

ENTERPRISE VALUE AWARDS
CIO COMMUNICATIONS, INC.
492 OLD CONNECTICUT PATH
P.O. Box 9208
FRAMINGHAM, MA 01701-9208

4. THE NOMINATED ORGANIZATION

Please tell us about your organization (company, business unit, agency) in 500 words or less. Include information on:

- when the organization was founded;
- mission statement;
- major products and services;
- markets served;
- any other data you believe to be relevant in terms of general background.

5. THE NOMINATED SYSTEM

Tell us about the nominated system and demonstrate its importance to the organization by completing the following sections. Please limit your material to two pages.

SYSTEM DESCRIPTION: In one sentence or less, describe the system or IT initiative you are nominating (e.g., order-entry or document-management system; switch to a client/server architecture).

TECHNICAL PROFILE: Briefly describe the technology of the nominated system. Please include the names of major vendors and products. (NOTE: The examples provided here are meant to be illustrative, not all-inclusive.)

- **ARCHITECTURE** (e.g., client/server, mainframe)
- **HARDWARE** (e.g., mainframe/parallel processor, mini-computer/server, PCs, handheld devices)
- **SOFTWARE** (e.g., operating systems, database system, shells, application software)
- **SOFTWARE DEVELOPMENT TOOLS** (e.g., CASE, 4GLs, GUI developers, object-oriented development tools)
- **NETWORK/COMMUNICATIONS HARDWARE, SOFTWARE AND SERVICES** (e.g., modems, routers, e-mail packages, carriers and public networks)

6. BUSINESS IMPACT

Describe the primary business objectives of and value delivered by the IT investment. Please limit this section to five pages.

SCOPE AND IMPACT: Identify the functions (e.g., customer service, manufacturing, planning) that were changed by the system, the nature of those changes and their impact on the business.

STATEMENT OF VALUE: In one or two sentences, describe the business value delivered by the nominated system (please refer to "Defining Value" section on the first page of the application form).

BUSINESS VALUE DESCRIPTION: In detail, describe *how* the system delivers the value identified above. Also describe any added value delivered, whether intentionally sought or serendipitously encountered.

THE IMPORTANCE OF IT: Identify the different components of the overall business change (e.g., business reengineering, downsizing, cycle times). Explain the importance of the IT component to the overall business change. Could the results have been achieved without IT?

COLLABORATION: Describe how the business unit and IS organization worked together throughout the project, from concept to implementation. What were the specific tasks fulfilled by the business unit? The IS organization?

7. QUANTIFYING ROI

Provide a detailed, one-page summary of the nominated system's investment costs (including all upfront development expenses and annual maintenance charges). Also provide estimates of returns (including increased profits,

reduced costs and indirect cost-avoidance). Estimates of costs and returns should be made per annum over a five-year period.

8. TRUTH OF INFORMATION/RELEASE

The following release must be signed by both nominating executives if the application is to be considered. *Unsigned releases will invalidate the entry.*

I HEREBY STATE that the information provided is true and complete to the best of my knowledge and belief.

I AUTHORIZE the release and use of, in connection with the Enterprise Value Awards program, any and all materials furnished by me or others at the company contacted for this judging. I understand that information submitted on this application or subsequently gathered during the evaluation and judging process may be used in articles or any other type of publicity relating to the Enterprise Value Awards program.

I ALSO AUTHORIZE the release and use of my name, my company's name and my likeness, including but not limited to any photographs and any recording of my voice or image that may be taken of me for *CIO Magazine*. I agree that no compensation shall be due me or my company for such usage.

I RECOGNIZE that failure to meet these conditions or to provide sufficient material that can be published can cause the application to be rejected at any point in the process at the sole discretion of the sponsors.

1.

▲ SIGNATURE OF NOMINATING I.S. EXECUTIVE

DATE

2.

▲ SIGNATURE OF NOMINATING BUSINESS EXECUTIVE

DATE

9. OTHER EDITORIAL OPPORTUNITIES

If you are not selected as an award recipient, are you willing to be contacted for inclusion in other articles in *CIO Magazine*? YES ☐ NO ☐

How did you learn about the Enterprise Value Awards program?

- | | |
|---|--|
| ☐ CIO MAGAZINE | ☐ ACADEMICIAN |
| ☐ CONSULTANT | ☐ IS STAFF MEMBER |
| ☐ SYSTEMS INTEGRATOR | ☐ OTHER PUBLICATIONS |
| ☐ PR AGENCY | ☐ VENDOR |
| ☐ ADVERTISING AGENCY | ☐ OTHER (PLEASE IDENTIFY) |

CHECKLIST

HAVE YOU FILLED OUT...?

- ☐ Company/Business-Unit, Entrants and Supporters Information

HAVE YOU INCLUDED ON SEPARATE PAGES...?

- ☐ Nominated Organization
- ☐ Nominated System
- ☐ Business Impact
- ☐ Return on Investment

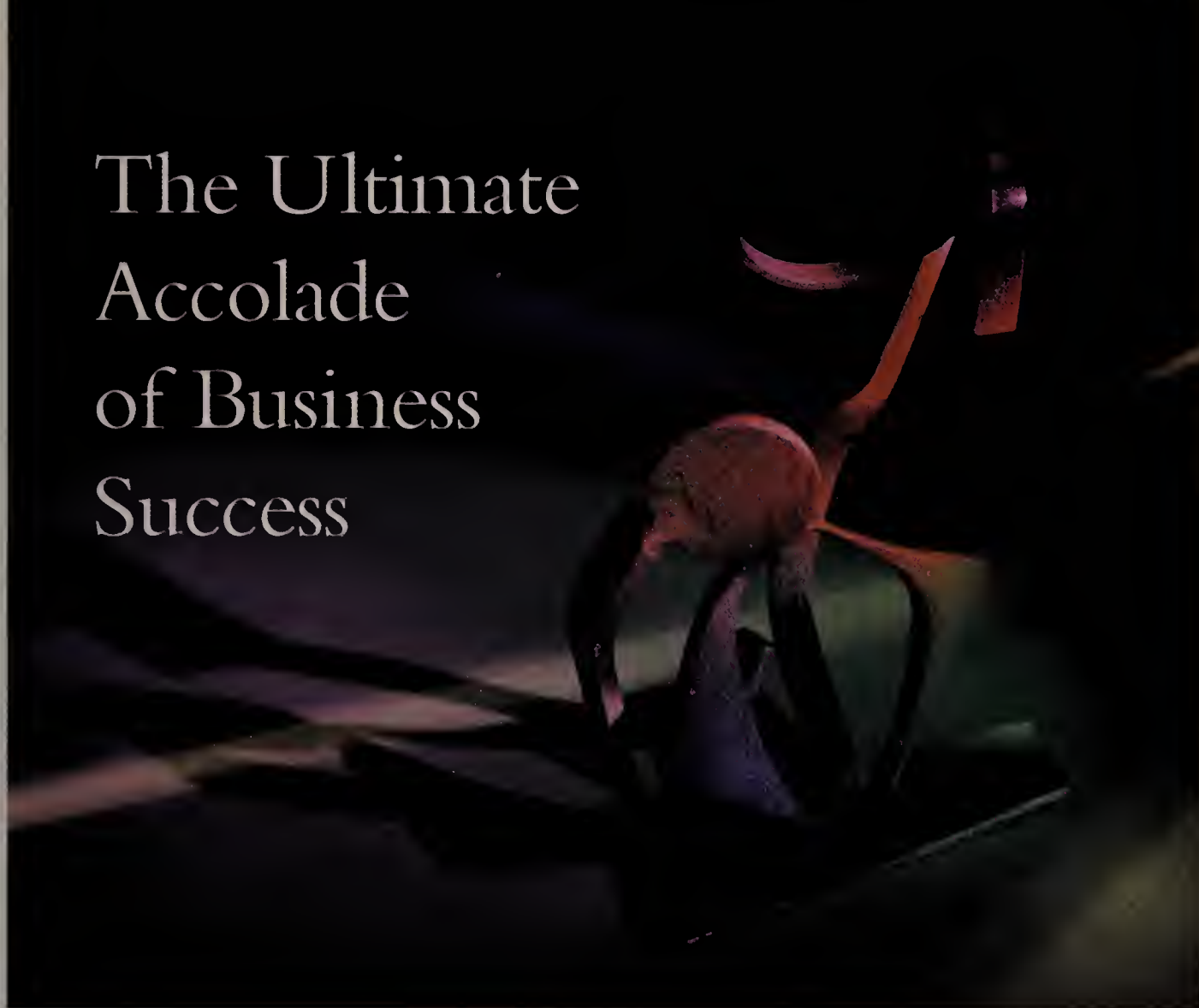
HAVE BOTH ENTRANTS SIGNED AND DATED...?

- ☐ Truth of Information/Release

HAVE YOU CHECKED OFF...?

- ☐ Other Editorial Opportunities
- ☐ How you learned about the Enterprise Value Awards program?

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SCULPTURE BY DAVID SHAPIRO; PHOTO BY RALPH MERCER

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POSITIONING IT AS A BUSINESS ASSET

Yet the CIO Enterprise Value Award goes beyond recognition. It is an opportunity to provide hard, tangible facts about ROI from information technology to the business community at large. It is an opportunity to demonstrate how partnering between business and technology executives can lead to the achievement of strategic objectives. By communicating the payback, *CIO* hopes to encourage other businesses to invest wisely in IT to ensure their survival in a fiercely competitive global market.

DO YOU QUALIFY FOR AN ENTERPRISE VALUE AWARD? FOUR CRITERIA ARE ESSENTIAL:

1. A return of value to the enterprise (see "Defining Value" within this application)
2. A measurable financial return attributable to the system
3. The pervasiveness of information technology—in other words, the strategic objective could not have been met without IT's contribution
4. Collaboration between an IT and business executive

If your innovative solution meets the above criteria, please fill out this Enterprise Value Awards application form. The Feb. 1, 1997, issue of *CIO* will feature profiles of the winning organizations and the executives who have proved that their strategic technology investments have had a positive and sustained impact on enterprise value.

In February 1997, *CIO* will host a special awards ceremony honoring the Enterprise Value Award winners at the annual CIO Enterprise Value Retreat.

For more information, please contact Lisa Kerber at (508) 935-4449.

ENTERPRISE VALUE AWARDS TIMELINE

APPLICATION DUE: July 1, 1996

JUDGES SELECT WINNERS: October 1996

WINNERS ANNOUNCED: October 1996

AWARDS CEREMONY: Feb. 2-5, 1997
at the CIO Enterprise Value Retreat

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John P. Glaser, PhD
Vice President, Information Systems

Jeffrey Otten
CEO

GENSYM CORP.

Troy A. Heindel
CIO & Vice President, Support Services

Lowell Hawkinson
Chairman & CEO

MCDONNELL DOUGLAS HELICOPTER SYSTEMS

Andrew Miller
Director, Information Technology

William R. Ringer
Business Development Representative

ROCKWELL INTERNATIONAL CORP. SPACE SYSTEMS DIVISION

Kodumudi S. Radhakrishnan
Division Director, Information Management

R. M. Glaysher
Vice President & General Manager

TELOGY INC.

Sateesh B. Lele
CIO & Senior Vice President

Anthony M. Schiavo
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UNITED HEALTHCARE CORP.

James P. Bradley
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CIO

Kathy Walstead-Plumb
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more complex environment accounts for more than 70 percent of the total cost of client/server computing, and that cost is largely borne by end users. Much of that labor cost is hidden and difficult to capture using traditional cost accounting methodologies. Even when end-user labor is excluded as an expense, client/server is still 37 percent more expensive than mainframe/terminal computing. Because different client/server configurations result in different total costs of ownership, companies should conduct cost analyses tailored to their own environments before embarking on a client/server project.

Finding the Payoff

Although cost is important, it is only one side of the equation. In the study of the business value of client/server, a reduction in IT budgets was the least common benefit cited by respondents. Most frequently, companies invest in client/server to improve the functionality, flexibility and responsiveness of business systems. Others build client/server systems to improve access to corporate information or to increase employee productivity.

A third of the respondents had measured (or at least closely estimated) the value of client/server. On average, that value was \$50,000 per user per year. That takes into account some unusually large responses. But even the median (or midpoint) value was an impressive \$10,000 per user per year.

Other Gartner Group research confirms that client/server applications provide a major payoff at the end-user level—making the end user more productive, smarter, more responsive, more collaborative and a better decision maker. Client/server computing provides a level of user functionality and ease of use not found on legacy systems. For instance, business tools like electronic spreadsheets, now indispensable in many planning organizations, essentially do not exist for mainframe/terminal systems. End-user benefits can more than offset the added cost of client/server.

The IS organization must deter-

mine which client/server applications will provide the biggest payoff. To do that, IS executives must examine the nature of the end-user tasks in specific applications. Although client/server is appropriate for a spectrum of applications, large client/server projects more commonly involve customer service and support, accounting and

Gartner Group research confirms that client/server applications provide a major payoff at the end-user level—making the end user more productive, smarter, more responsive, more collaborative and a better decision maker.

finance, and sales support applications. Jobs performed by professional or high-level clerical workers who depend on access to multiple data sources to make decisions are prime candidates for client/server applications. Complex order-entry jobs—involving, for example, the determination of stock levels and locations, quality specifications, freight services and earned discounts—are also good candidates.

The payoff for the companies surveyed came in a variety of shapes and sizes:

Customer Satisfaction: A European communications company used client/server to rework its order-entry and installation processes for new telephone service. A number of processes that were previously sequential can now be launched simultaneously to access multiple legacy systems that drive various business procedures. The number of process handoffs among various departments and individuals was cut by more than half. As a result, the time necessary to respond to requests for service was reduced

from two weeks to two days. Not surprisingly, customer satisfaction increased from 78 percent to 91 percent.

Operating Expense Reduction: A transportation and freight company used client/server to process and route fax documents to the proper clerk for handling, significantly reducing expenses. A utility company used client/server to update and track purchases of IT hardware, saving more than \$100,000 annually by eliminating manual tracking.

Competitiveness: A mortgage insurance company used client/server to simplify the task of processing applications, which often differ by state and institution, saving the company more than \$5 million over three years.

Efficiency: A communications company used client/server to launch multiple process steps—such as order entry, credit check, premises wiring history, new number assignment and work scheduling—from a PC workstation while the customer was still on the telephone. Before the system was installed, the process was a sequential set of steps launched only after the customer telephone call was completed.

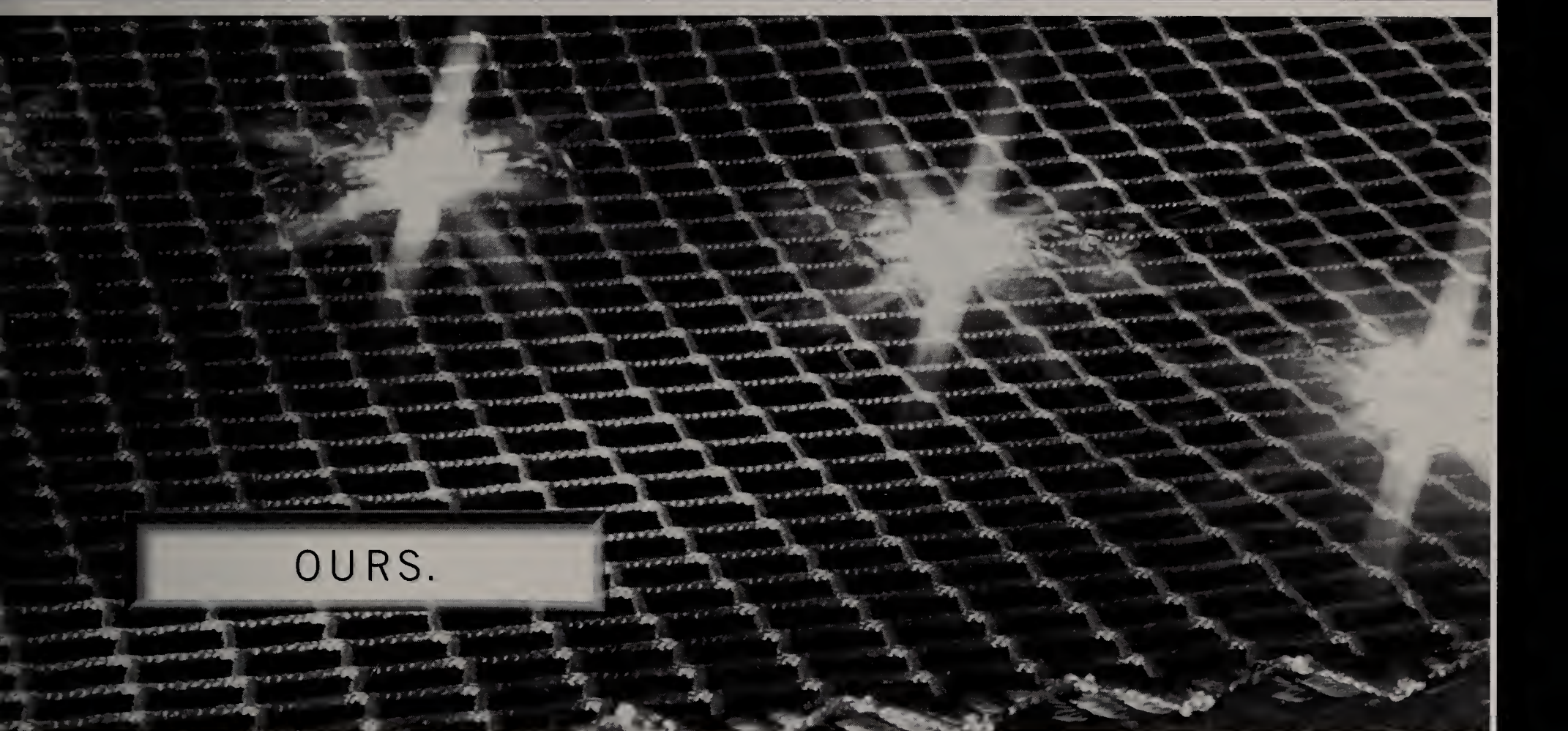
Data Quality: One company saw a tenfold reduction in the number of errors for an order-entry process once a reengineered process using client/server was introduced. A gas transmission company estimated a \$1 million benefit in processing more accurate data in a gas-flow monitoring application for industrial users.

Business Decisions: A company that provides patient histories to physicians performing medical treatment installed a client/server system to help doctors make more informed decisions. The doctor, as the end user, receives an up-to-date history of patients' allergic reactions and possible drug interactions. The system was estimated to be worth more than \$500,000 per year in loss avoidance by helping doctors make safer decisions at the time of treatment.

The size and scope of client/server projects vary as well. Companies needn't shy away from important business processes that span the en-



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terprise. Twenty of the projects studied had more than 2,000 client workstations; some involved more than 20,000 desktops. The average number of servers per project was close to 100, with some involving as many as 3,000. Mainframes and midrange systems acted as servers in more than 40 percent of the projects studied, with many projects incorporating systems from multiple vendors. We believe that mainframes and large centralized processors will continue to play a key role in the client/server hierarchy for more than two-thirds of vital business processes through the year 2000.

Vendors are starting to aggressively market products that satisfy the needs of large, distributed projects. IBM Corp. (OS/2, AIX and LAN Server), Hewlett-Packard Co. (HP-UX) and Microsoft Corp. (Windows NT) are focused on the large enterprise and the large, replicated-server opportunity.

Build or Buy?

Consultants and systems integrators are often used to augment internal staffing and capabilities. For the next few years, more than 50 percent of mission-critical client/server projects are likely to use consultants and integrators for some elements of their implementation; typically, these outside providers help redesign processes and code the applications.

Using outside assistance does not reduce project development time. The study found that projects containing some level of outside assistance took, on average, about four months *longer* to implement than those done completely internally. The differences vary by project size, with a delta of nearly a year for large projects and only several months for small projects.

The primary reason for using outsiders is to transfer skills, not to speed up project deployment. Typically, a company without the training, experience or skills necessary to do the complete client/server job goes outside the organization to hire the expertise and plans for the skills

of the consultant to be transferred into its own organization. After the initial project, it can implement other client/server projects using internal staff.

One of the key decisions in a client/server project is whether to buy or build the application. Although conventional wisdom dictates that client/server is a purchased application arena, much of the "buy" reputation comes from early client/server projects, which were typically small and workgroup-oriented. For large, enterprisewide business solutions, client/server is more often an internal affair. More than three-quarters of the companies in the survey chose to

More than three-quarters of the companies in the survey chose to build their client/server systems internally rather than purchase them on the outside and make modifications.

build their client/server systems internally rather than purchase them on the outside and make modifications.

Enterprises should expect more client/server application code to be available in the future as such vendors as SAP AG, PeopleSoft Inc. and Dun & Bradstreet Software deliver products. Even with that expanding vendor choice, however, more than half the medium-size and large client/server projects will continue to consist of internally developed code or purchased code that will require significant modification to fit a specific corporation's requirements.

Buying an application instead of building one does not appear to reduce implementation time for a project. The average implementation time for purchased applications was 19 months, while it was 18 months for building the application internally.

Enterprise Management

Enterprises contemplating use of the client/server model must manage expectation levels with execu-

tives and end users and set realistic implementation schedules. With careful planning, the journey should be rewarding. Among the guidelines to keep in mind:

- Conduct a study of the five-year total cost of ownership for proposed client/server environments, including end-user labor and end-user support labor.

- Focus attention and investments on optimizing the major cost elements. In most cases, these are related to labor, not technology.

- Develop client/server architectural guidelines that focus on reducing complexity and enhancing interoperability within and across platforms.

Optimize at the client/server system level, not the individual component level.

- Reduce complexity for end users and IS staff by limiting technology investments to a small set of products and to vendors that cooperate well. That rule applies especially to desktop application suites, cross-enterprise purchased applications, network operat-

ing systems, application development tools, and tools for network and systems management and end-user support.

- Invest in end-user and IS staff training. Training should include both formal classroom instruction and tools to bring informal education to the desktop.

- Invest in systems management and end-user support tools. Use technology to automate labor-intensive tasks such as electronic software distribution, asset management and server file backup.

- Look to the end user to quantify the benefits of client/server applications. The benefits of client/server accrue to the end-user organization, not the IS organization, so the end user must be able to vouch for the project's success. **CIO**

Ken Dec, vice president and research director in the IT Service Deployment group at Gartner Group Inc. in Stamford, Conn., can be reached at 203 316-1111.



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Who's Minding the Storage?

One of the byproducts of the information age is the spectacular growth in a company's need to stow crucial data.

Luckily, it's getting easier and cheaper to do.

BY DANIEL GROSS

Next to speed, a computer's capacity to store information is the true measure of its power. After all, without the ability to collect precious data and programs, a computer would be nothing more than an expensive calculator.

Not too long ago, companies stored their data the way they stored their hard goods—in out-of-the-way warehouses where the real estate was the cheapest. But enterprises of all types are becoming increasingly aware that accessible, centrally located data warehouses are crucial cogs in the business machine. "Storage is becoming much more strategic as a component in the IT environment," says Peter Gibbs, director of marketing for Data General Corp.'s Clariion storage product line. "The notion of protecting the integrity of the data and being able to manipulate it is crucial because many companies' corporate assets are riding on how storage is managed."

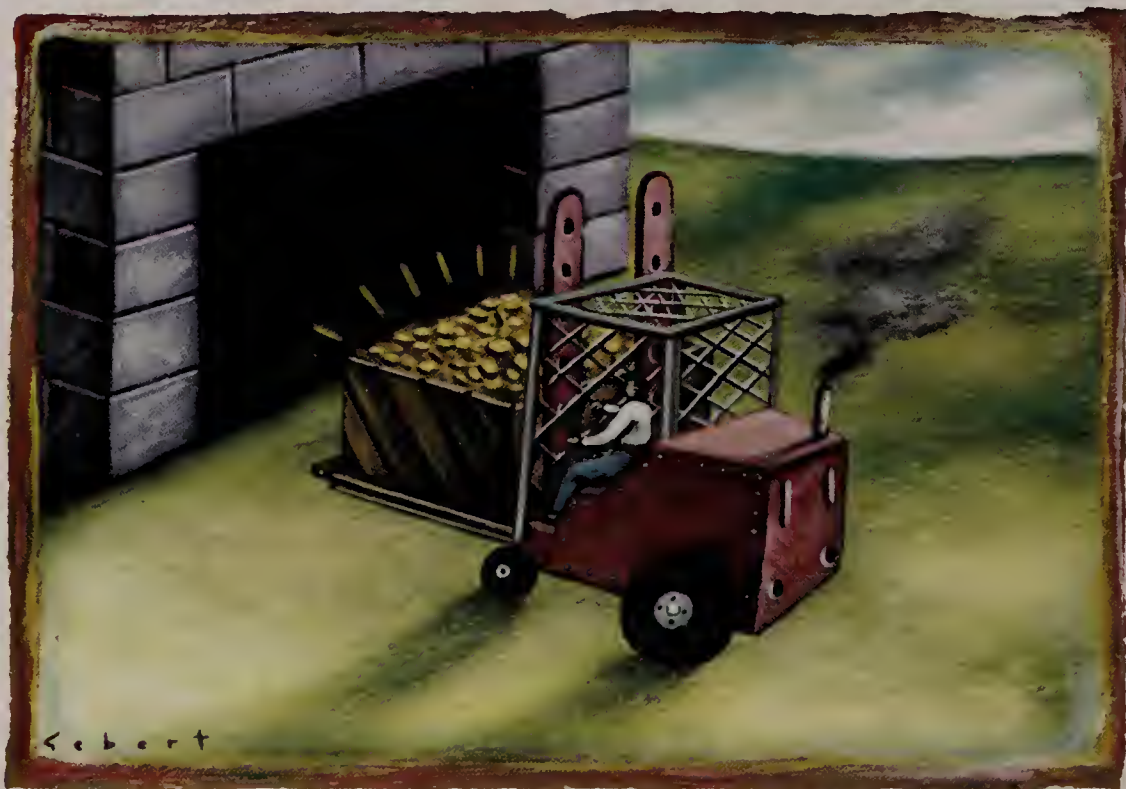
As a result, the demand for more storage capacity is growing at an as-

tronomical rate. The FirstSearch service at the Online Computer Library Center (OCLC), for example, maintains 48 databases, including one that contains 34 million bibliographic entries from hundreds of libraries throughout the United States. Since 1992, the OCLC has boosted its storage capacity eightfold, from 200GB to 1,600GB, adding more than 700GB in the last 12 months alone. "And we'll probably install another terabyte within the next 12 months," says Jerry Lynch, director of operations at the OCLC in Dublin, Ohio.

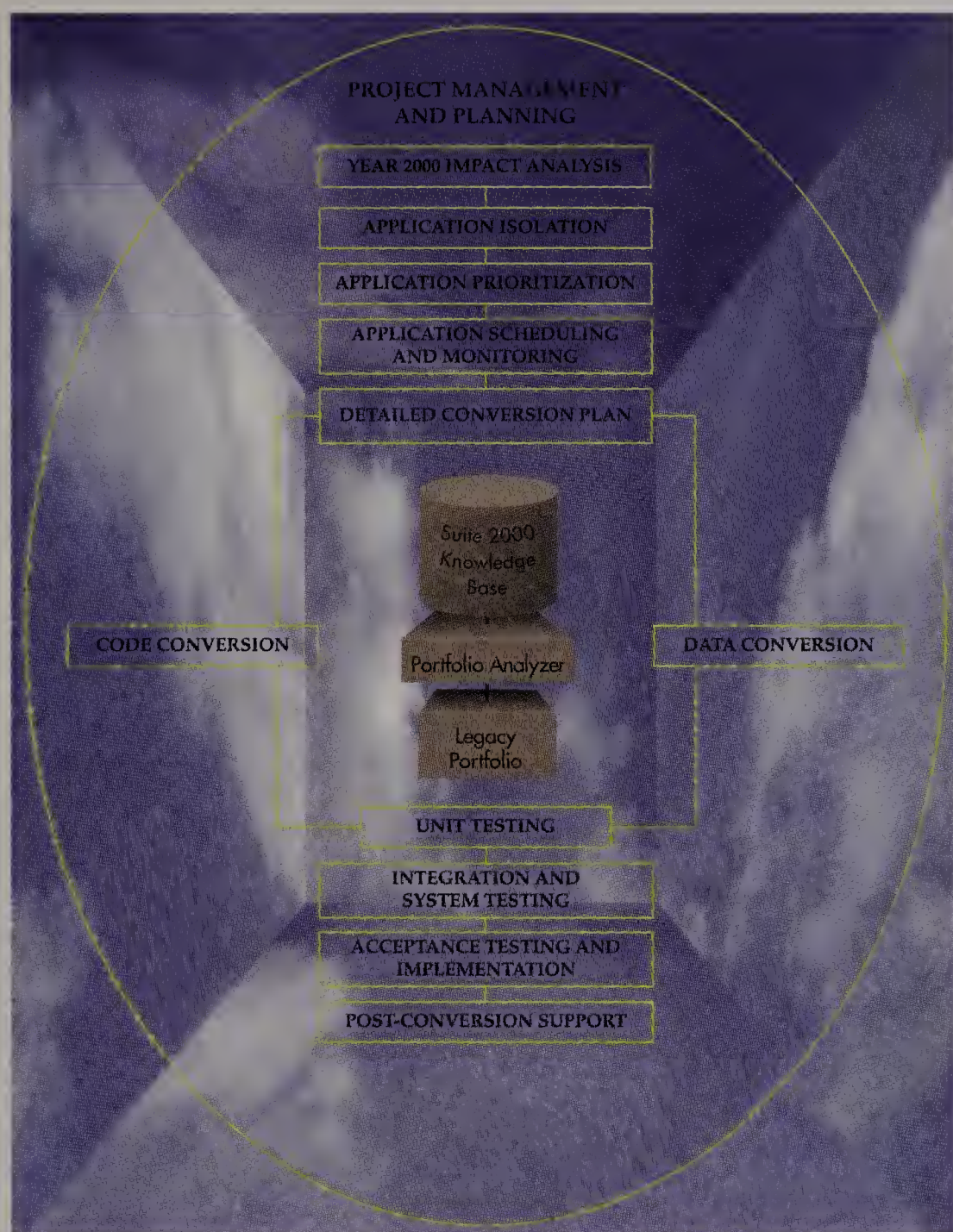
The OCLC's voracious appetite for storage represents the growing hunger at companies in such industries as aerospace and retail. "People are consuming storage at a rate that has increased by one or two orders of magnitude. Some might eat up 1GB per month," says John Freeman, president of Strategic Marketing Decisions Corp. in Los Gatos, Calif.

And, as with virtually every other sector of the hardware industry, storage devices are also getting smaller with each passing year. Today, IT executives can stow 80GB of data in a container about the size of a two-drawer file cabinet. Nine gigabytes of data can now fit in the same space that in 1992 held only 857MB. EMC Corp.'s Symmetrix 5500-9, which covers about 17.25 square feet of floor space, can hold a terabyte of data—1 trillion characters or 250 million pages of text.

The cost of storage is shrinking, too, at the rate of 30 percent to 40 percent per year, according to Nick Allen, vice president and research director at the Gartner Group Inc. in Stamford, Conn. Both mainframe and client/server storage costs have fallen sharply in just the last five years. IBM Corp.'s 7133 SSA (serial storage architecture) product costs less than \$1 per megabyte, according to



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Edward Gershenson, a consultant with Optimum Configurations Inc. in Sudbury, Mass.

In September, when the OCLC installed a 270GB Iceberg fault-tolerant disk-storage system from Storage Technology Corp. on top of its existing IBM capabilities, it paid less than \$2.50 per megabyte; five years ago, it would have cost \$10 per megabyte, according to Lynch.

But the cost of storage goes far beyond the hardware. "When you're dealing with a mainframe, for instance, the cost of storage alone is a relatively minor part of the overall cost," says Gershenson. Experts say that for every 50 cents you invest in storage hardware, you will spend at least another \$3 to \$4 to manage and maintain that hardware.

Make no mistake: Storage purchasers don't just buy empty shells. What IT managers are getting for their money, in essence, are warehouses whose contents can be monitored and manipulated. In most enterprises, a great deal of data is inactive: For 80 percent of the time, less than 20 percent of data is accessed, according to Ray Cosyn, director of storage marketing at Hitachi Data Systems (HDS) in Santa Clara, Calif., a seven-year-old joint venture between Hitachi Ltd. and EDS Corp.

As computers are programmed to recognize which information is used more, code is turning warehouses into intelligent storage areas. EMC's products, for example, contain software that analyzes how people use their data and predicts which blocks they will need to access most often. The products maintain this crucial information in an area known as "cache"—the layer of memory between the CPU and disk drives where data can be accessed quickly.

"The layer in the middle, known as the disk controller, is what makes all the difference. That's where all the software lies," says Charles A. Foley, vice president of open-enterprise storage systems at Amdahl Corp. in Sunnyvale, Calif. "That's what you're shopping for."

Storage products are also becoming

more user-friendly. "When we sell storage on a specific platform, we sell a platform kit that contains some software elements like graphical interfaces that make it easier to use," says Paul Feresten, vice president of sales and marketing for Digital Equipment Corp.'s storage business unit in Shrewsbury, Mass.

In addition, most offer convenient

there while enabling access to the hoard when needed. "We serve 600,000 electric customers as we buy and sell electricity. In order to provide the best possible service, we need instant access to information," says Blake Little, senior analyst at the Salt River Project, a Phoenix-based utility that last year switched from IBM controllers and

"The notion of protecting the integrity of the data and being able to manipulate it is crucial because many companies' corporate assets are riding on how storage is managed."

—Peter Gibbs

scaleability—the ability to add storage easily. "The majority of the vendors today have chosen a very modular design approach so that you can add capacity in the blink of an eye," says Foley.

NetCarta Corp., a Scotts Valley, Calif., company that makes software for producing maps of World Wide Web sites, recently bought HDS's 5700 storage product to back up its Windows NT and Sun client/server systems. It paid about \$1.10 per megabyte for capacity in which it will store a repository of Web maps that its customers will be able to access online. "We're starting with 20GB, and we expect that requirement to ramp up over the next few months, eventually pushing 100GB," says Tom Tansy, vice president of sales and marketing for NetCarta. "Because we're just launching our products and services, our needs now are relatively modest. We decided to buy in small increments."

Another crucial criterion that storage shoppers seek is data integrity. "If you took 100 gold bars and put them in a warehouse, you'd want to make sure there are 100 gold bars when you go back to pick them up," says Amdahl's Foley. Today's most advanced storage products ensure that the gold bars will be

disk drives to EMC's Symmetrix line. "Our information has to be accurate. It's a 24-hour-a-day, seven-day-a-week expectation."

All this demand is causing unprecedented growth in the mainframe storage market. The number of terabytes shipped rose from 906 in 1994 to 1,600 in 1995—a 76.6 percent increase. And it is expected to rise another 56 percent in 1996, according to David Vellante, senior vice president at International Data Corp. in Framingham, Mass., which has the same parent company as CIO.

In the mid-1980s, IBM was virtually the only choice in the \$4.35 billion mainframe—or direct access storage device (DASD)—market. But because of fierce competition and similar technology, no one player dominates the market today, and Big Blue's edge in storage has eroded. "We've gone from an oligarchy where IBM had 95 percent of the market to a situation where no one company has a majority of market share," says Gartner Group's Allen. "Now, people have a choice."

Those choices include a half-dozen major vendors for mainframe customers, including IBM, HDS, Amdahl, Storage Technology and EMC. Based in Hopkinton, Mass., EMC has seen its market share rise from

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less than 1 percent in 1990 to a whopping 41 percent last year, beating out IBM for the top spot in the mainframe market. Over the same period, EMC's annual revenues rose from \$190 million to \$1.92 billion.

"We had at least five different storage providers that we could have chosen from," says Salt River Project's Little. "The price and perfor-

market has already surpassed the mainframe market.

As companies move into the burgeoning open-systems environment, where crucial data may be stored in several different locations, the task of managing data is creating new challenges. According to market researcher Find/SVP Inc. in a 1995 report commissioned by EMC, 85

amount of space it needs.

One relatively new storage technology, redundant arrays of independent disks (RAID), acts as a less cumbersome insurance policy for stored data. RAID comes in six levels, ranging from 0 through 5, with each number representing a different configuration of security, performance and price; all provide an acceptable level of security.

RAID spreads data across many disks; in the case of a disk failure, RAID will reconstruct the data using compressed data stored on a redundant disk. A company could spread a 4GB file across four different disks and maintain a version of the data on a fifth disk using only one additional gigabyte. If one disk fails, the system can determine which information is missing and reconstruct it from the low-storage disk. This tactic requires the enterprise to expand its memory by only 16 percent to 25 percent.

And RAID is getting smarter. Many products that include RAID employ algorithms that can tell which information is used more often and therefore deserves a higher level of protection. Hewlett-Packard calls this feature AutoRAID. "It self-configures. It continually looks at files that are being used most frequently and keeps them in a high-performance mode. Those files that aren't used often are stored in a lower-performance, lower-cost mode," says Roger Archibald, marketing manager for Hewlett-Packard Co.'s information storage group in Boise, Idaho.

But because of the added insurance, this storage costs more. Digital Equipment's StorageWorks RAID Array 410 RAID-ready subsystem, which runs on Sun, IBM and HP platforms, lists for \$18,754 for 4.35GB—or about \$4.31 per megabyte. Increasingly, however, IT executives find it's worth the investment to protect their data. "If you can't access your data," says EMC's Blaschke, "you can't be competitive." **CIO**

Daniel Gross is a freelance writer based in New York. He can be reached at dangross@panix.com.

"People are consuming storage at a rate that has increased by one or two orders of magnitude. Some might eat up 1GB per month."

—John Freeman

mance of EMC's Symmetrix was better, and some value-added features tipped the scale."

The heightened competition in the growing client/server arena is also creating an array of storage products whose capabilities are approaching those of the powerful mainframe. Mission-critical data is often no longer located on a single server but distributed over the enterprise. "People are now doing the same kinds of critical applications on open systems that they were doing on mainframes years ago," says Dick Blaschke, vice president of product marketing at EMC.

"The definition of the enterprise is becoming more and more complex," says Don Swatik, vice president of strategic planning at Storage Technology, whose flagship tape-storage business accounted for about 60 percent of the Louisville, Colo.-based company's \$1.87 billion in revenues in 1994. "Today, it is typically five to 10 different platforms that all need to work together in unison to really support the business requirements of the enterprise," he adds.

Most of the traditional mainframe storage providers have, indeed, developed products for the client/server world, where they now compete with players like Data General and Digital Equipment. Analysts say that the size of the client/server storage

percent of the 600 information technology executives surveyed are concerned that they can't effectively manage critical business information spread out among computers in the organization. Adding to the CIO's level of anxiety is a growing array of storage products from which to choose in formats that include tape, optical disks and traditional hard-disk drives. "The need to secure and back up the information is as important on the open side today," says EMC's Blaschke.

Many companies now make products that can plug conveniently into multiple platforms. For example, Amdahl's Series 3000 products, which begin at \$30,000 for 10GB of storage, can support Sun, IBM, Microsoft and Novell platforms. And HDS's Hilander family of storage systems offers a central storage backup for entire networks. A Hilander with a capacity of 48GB lists for about \$18,600.

A company's data can be crucial to its operation, and a storage system failure can cripple it, whether it's a financial institution or a mail-order operation. The ultimate safeguard offered by storage providers is mirror mapping, in which a host maintains duplicate copies of data on separate disks. Unfortunately, this unwieldy duplication forces an enterprise to purchase twice the

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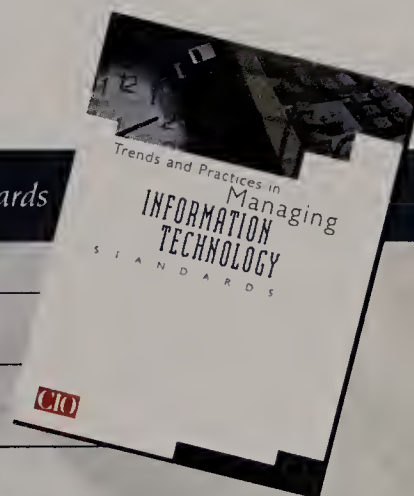
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Safety Pays

Knowledge can be power or, in this case, health. Workers' compensation is one of the fastest-growing costs in business. And with safety costs on the rise, managers must find ways to reduce those health care expenses.

WorkWell Health & Safety Systems Inc.'s WARE for Windows (Worksite Accident Reduction Expert) is a corporatewide injury and illness knowledgebase that enables managers to analyze, consolidate and standardize existing safety data across departments.

With WARE, managers can apply quality paradigms to injury and illness data to identify and correct common causes of injuries. As a result, WARE helps companies reduce injuries and workers' compensation claims by automating injury and illness record keeping and by providing feedback for improvement. It also reduces fines from Occupational Health and Safety Act (OSHA) violations and turns OSHA record keeping requirements into cost-prevention opportunities.

To heighten a manager's understanding of incident data, WARE uses statistical process control analysis, which considers quality problems related to health issues and looks for trends to improve them. Findings are presented in chart format that helps managers detect ways to prevent injuries rather than just react to special cases. WARE also aligns safety improvement teams across the enterprise by using the same problem-solving techniques.

WARE is Windows-based and runs on a 486 or higher microprocessor. Dynamic data exchange and open database connectivity capabilities make it easy to share injury and illness data on a companywide basis. For further information, contact WorkWell Health & Safety Systems at 800 860-7741.

Best of Hybrid

Many companies realize that they can gain valuable competitive advantage by connecting to the World Wide Web. Until now, they had to choose between the performance of a Unix server or the affordability and ease-of-use of a PC server to create and maintain a professional presence on the Web. But no longer. Intergraph Computer Systems' InterServe Web server family is based on Intel's X86 architecture, runs on the Microsoft Windows NT Server operating system and features easy-to-install software, including Microsoft's Internet Information Server, hypertext markup language (HTML) authoring tools, simple mail transport protocol (SMTP) and post office protocol (POP) services.

InterServe Web server products include the InterServe Web-30 desktop for businesses with small external Web sites, the InterServe Web 300 desktop for midsize Internet sites or intranet applications, the InterServe Web-610 desktide configuration

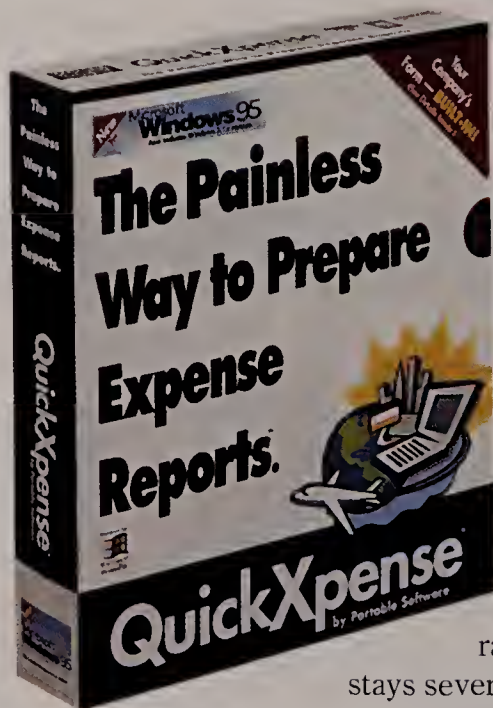


for large Web sites and the InterServe Web-630 desktide configuration for companies with very large databases and heavy Internet traffic. Intergraph's Firewall-300 limits traffic between the Internet and an intranet and includes hardware, software and consulting services needed to achieve various levels of security. All InterServe Web server systems are field-upgradeable to twice the number of processors delivered in the base configurations.

Prices start at \$8,900 for the InterServe products. For more information, call 800 763-0242 or visit <http://www.intergraph.com/ics>.

Quick Fix for T&E Blues

Employees are always eager to be reimbursed for their expenses, but they are often less fervent about filling out the complicated reports that most companies require. Portable Software Corp.'s QuickXpense for Windows 95 takes the sting out of expense reports by minimizing data entry and eliminating receipt sorting. At the same time, QuickXpense enables corporations to gain better control over the process of expense reporting and reduces the costs of processing reports.



QuickXpense includes 35 industry- and occupation-specific expense report forms. Companies also have the option of creating customized XpenseForms. XpenseLink enables employees to pull their corporate charge card transactions directly into QuickXpense with the click of a mouse. Receiving transaction data online increases accuracy because it eliminates data-entry errors and provides automatic reconciliation, ensuring business travelers reimbursement for every expense on their charge cards. In addition, QuickXpense also includes HotelXpert, a program to simplify hotel-expense entry. When an employee reports an overnight stay in a hotel, HotelXpert automatically fills in all standard information, including room rate and tax over the specified date range. This feature is especially helpful when a business traveler stays several nights at a hotel because it eliminates duplicate data entry.

QuickXpense requires a 386 or higher microprocessor, 8MB of RAM, 4MB of hard-disk space, a VGA or higher-resolution video adapter and a mouse or pointing device. The product costs \$99.95. A trial version of QuickXpense can be downloaded from the company's home page at <http://www.quickxpense.com>. For more information, call Portable Software at 800 478-7411.

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Torrential Savings

Faced with mandatory restrictions and demanding customers, a water utility turned to client/server technology and in the process realized significant financial benefits

Sometimes organizations have to be pushed into implementing new systems. Before the state of California imposed water restrictions, customer service at the Eastern Municipal Water District (EMWD) in San Jacinto struggled against a tide of increasing demand. The problem centered around an outmoded billing system, which didn't support queries for historical data or allow IS to quickly modify accounts. Although it took a drought to compel EMWD to invest in new technology, annual savings of more than \$330,000 prove it was a decision that really holds water.

By 1990, EMWD's customer base swelled by as many as 3,000 new accounts each month. To deal with the demand, the district hired a dozen customer service employees who were little more than drops in the bucket when it came to alleviating backlogs. Much of the mainframe-based billing system consisted of undocumented code. Modifications to the system took months and sometimes longer. Adding a field for credit information took a year because programmers first had to decipher the legacy code.

Service representatives had dumb terminals to access customer information such as names and addresses, but historical data wasn't stored on the system. The inefficient process to handle customer inquiries

required 18 service reps to search through microfiche records.

The inefficiency came to a head at conservation time. EMWD had assigned quotas based on past water usage and imposed penalties when customers exceeded them. Many customers wanted a billing structure under which they were charged only for water units they consumed. The existing billing system couldn't support that kind of change.

"Change wasn't a desire," recalls Keith Bratisax, a programmer analyst. "It was a requirement."

A team of employees hashed out requirements for a new system that could support billing as well as applications for customer accounts, service orders and planning.

Due to flexibility concerns, IS opted to license source code and modify it rather than purchase a packaged product. The mainframe was ditched for a fault-tolerant NCR Corp. server. Dumb terminals gave way to Windows-based PCs.

The result is known as the customer online information network system, or COINS. The system, installed in 1993, is customizable and automates all crucial customer service and billing applications.

EMWD realized immediate positive results. "We had so little information before that every new piece of data made a huge difference," says Jane Mathews, customer service manager. About 75 people use PCs to access customer accounts including

updated billing information and service orders. Instead of taking a week to answer customer inquiries, service reps have all relevant information available at the push of a button. "This makes the customer happy, which makes life much easier for our employees," says Mathews.

Records dating back to 1992 are readily available online. Service reps can also add comments about previous contacts or problems to customer accounts. Status reports on service orders are available online as well, so service reps no longer have to deal with microfiche or track down paper-based orders.

EMWD saves more than \$252,000 annually by eliminating microfiche and the associated staff, and reducing downtime and printing costs. Lower maintenance costs save another \$78,604. With shut-off and collection notices for delinquent bills online, EMWD wrote off \$100,000 in unrecoverable bills in 1995. Previously, write-offs totaled \$1 million because processing delays gave delinquent customers time to skip town.

EMWD may even generate revenues by selling COINS. In any event, the days of inefficient customer service at EMWD are water under the bridge.

—Jennifer Bresnahan

VITAL STATISTICS

Organization: Eastern Municipal Water District, San Jacinto, Calif.

Application: COINS, a client/server-based customer information and billing system

Technologies: An NCR Corp. midrange server running a Progress Software Corp. relational database and 4GL; IBM Corp.-compatible PCs running Windows; and a Novell Inc. network

Scope: 75 employees in the customer service and finance departments

Sponsor: Anthony J. Pack, assistant general manager of administration and finance

Objective: Design and build a billing system that is flexible enough to accommodate future growth

Payoff: More responsive customer service; savings of more than \$330,000 due to eliminating microfiche and staff, and reduced maintenance costs; reduced write-offs by \$900,000 in 1995

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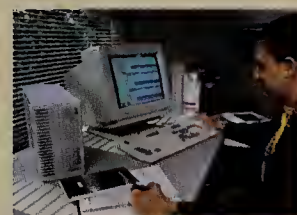
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